

## **ATTACHMENT C**

### **COMMENTS AND RESPONSE**

A copy of the letters and correspondence received on the Draft Environmental Impact Statement for the Hurricane Protection and Beach Erosion Control, Dare County Beaches (Bodie Island Portion), Dare County, North Carolina and the U. S. Army Corps of Engineers, Wilmington District response to each comment.

## **1.0 Introduction**

This attachment includes all comments on the Draft Environmental Impact Statement (DEIS) for the Hurricane Protection and Beach Erosion Control, Dare County Beaches (Bodie Island Portion) and responses by the U. S. Army Corps of Engineers, (USACE) Wilmington District. These comments are listed in the following order: Federal, State, and local agencies; elected officials, conservation groups; and interested businesses, groups, and individuals.

The Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act (NEPA), 40 CFR Part 1503.4 Response to Comments (b), states, "All substantive comments received on the draft statement (or summaries thereof where the response has been exceptionally voluminous), should be attached to the final statement whether or not the comment is thought to merit individual discussion by the agency in the text of the statement." Additionally, the Environmental Quality; Procedures for Implementing the National Environmental Policy Act (NEPA); Final Rule, 33 CFR 230.19 (c) Comments Received on the Draft EIS, states, "District commanders will avoid lengthy or repetitive verbatim reporting of comments and will keep responses clear and concise."

In keeping with these regulations, the USACE will respond to summaries of lengthy written comments. Additionally, in order to reduce repetition, responses will be made once to a comment and a particular issue. If the issue appears again, in another letter, the reader will be referred to the initial comment and response. Detailed responses will not be given to comments which repeat information in the DEIS, the Draft Feasibility Report, or state opinions on the proposed action. Form letters and signed petitions with multiple signatures are not responded to individually. In many instances, our response to a comment is indicated as "Noted." Noted means that the comment was evaluated and it will be considered in making the decision on whether to sign the Record of Decision.

## **2.0 PUBLIC AND AGENCY COORDINATION**

On July 5, 2000, the DEIS referenced above was mailed to Federal and State agencies and the interested public for a 45-day review and comment period. Recipients of the FEIS are listed in Table 8-1. Comments on the DEIS were received from the following:

### **Federal Agencies**

- US Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service
- Atlantic States Marine Fisheries Commission
- US Department of Commerce, Office of the Under Secretary for Oceans and Atmosphere, National Geodetic Survey
- US Environmental Protection Agency, Region IV
- US Department of the Interior, Fish and Wildlife Service

**State Agencies**

- NC Department of Environment and Natural Resources
- NC Division of Coastal Management
- NC Department of Cultural Resources
- NC Division of Water Quality
- NC Wildlife Resources Commission
- NC Division of Marine Fisheries
- NC Marine Fisheries Commission

**Local Agencies**

- The Outer Banks Chamber of Commerce
- Oregon Inlet Users Association

**Elected Officials**

- Dare County Board of Commissioners
- Mayor Clifton G. Perry, Town of Kitty Hawk
- Mary E. Quidley, Town Clerk, Town of Kill Devil Hills
- J. Webb Fuller, Town Manager, Town of Nags Head

**Conservation Groups**

- Biodiversity Legal Foundation
- Sierra Club
- Southern Environmental Law Center on behalf of the North Carolina Coastal Federation

**Interested Businesses, Groups, and Individuals**

- Outer Banks Association of Realtors
- Marian and William Clough
- Stephen and Margaret Burch
- Beverly Perdue Jenning
- Mrs. R. Bruce MacWhorter
- Mr. and Mrs. Donald J. Hughes
- Celeste Wescott Maus
- Gwendolyn S. Wescott
- Dr. and Mrs. Sedan
- Mrs. Norman F. Perry

**3.00 RESPONSES TO COMMENTS ON THE DEIS****4.00 FEDERAL AGENCIES**

- 4.01 U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NMFS), two letters dated August 11 and 22, 2000 from Carol S. Ballew, Acting Regional**

## **Administrator**

**4.01.1 NMFS Comment:** NMFS has reviewed your DEIS and determined that the proposed initial construction and periodic renourishment of a berm and dune on Dare County beaches, with the exception of any associated hopper dredging, is not likely to adversely affect any threatened or endangered species under NMFS purview. Hopper dredging of borrow areas off of Dare County is covered by the September 25, 1997, Regional Biological Opinion (RBO) for continued hopper dredging of navigation channels and borrow areas in the southeastern United States. Any hopper dredging associated with the proposed project must be performed under the RBO and all provisions of this RBO, or any issued subsequently, must be strictly followed. Any takes that occur during this project will be counted toward the Incidental Take Statement for the RBO.

**Corps Response:** Noted. All work will be done in accordance with the provisions of the Regional Biological Opinion. In addition, the even more restrictive measures of the Corps' South Atlantic Division Hopper Dredging protocol will be followed when appropriate.

**4.01.2 NMFS Comment:** This concludes consultation responsibilities under Section 7 of the ESA. Consultation should be reinitiated if new information reveals impacts of the identified activity that may affect listed species or their critical habitat, a new species is listed, the identified activity is subsequently modified or critical habitat determined that may be affected by the identified activity.

**Corps Response:** Noted. Consultation will be reinitiated if necessary.

**4.02 US Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NMFS), two letters dated August 18 and 22, 2000 from Andreas Mager, Jr., Assistant Regional Administrator, Habitat Conservation Division**

**4.02.1 NMFS Comment:** This responds to your July 7, 2000, request for comments on the Draft Feasibility Report (DFR) and Draft Environmental Impact Statement (DEIS) on Hurricane Protection and Beach Erosion Control Dare County Beaches (Bodie Island Portion), Dare County, North Carolina, Volume 1, dated June 2000. Also requested was our review and concurrence with the Essential Fish Habitat (EFH) assessment incorporated as a part of the DEIS pursuant to the EFH coordination procedures required by the 1996 Amendments to the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA).

The proposed beach nourishment project consists of the initial construction and periodic maintenance of a vegetated dune with a crest elevation of 13 feet National Geodetic Vertical Datum (NGVD) and a berm 50 feet wide with an elevation of 7 feet NGVD. The work involves two project segments; a 4.1 –mile long beach segment called the North Project Area and a 10.7-mile long beach segment called the South



Project Area, a 0.57-mile long transition zone is included on both ends of each segment for a total project length of approximately 17 miles. The proposed sand source for initial construction and periodic nourishment is two borrow sites designated as NI (800 acres) and S1 (5,700 acres) located one to two miles offshore in the Atlantic Ocean. An estimated total of 88.7-million cubic yards will be dredged during the 50-year life of the project.

**Corps Response:** The design cross-section for the project is correct. However, the southern limits of the south portion of the project (South Nags Head) have been shortened to eliminate the 3,000-foot transition that would have encroached onto the Cape Hatteras National Seashore. This modification was required as a result of the National Park Service (NPS) denial of a special use permit for placement of material within the Seashore. The NPS concluded that the placement of sand on the Seashore as part of the Dare County Beaches project would be inconsistent with the purposes of the Seashore. The south project area, which includes Nags Head and the community of South Nags Head, will now total 10.1 miles in length. This length includes 9.0 miles of main fill, a 0.6 mile transition on the north end, and a 0.5 mile transition on the south end. The limits of the north portion of the project have not been changed. The shortening of the south portion of the project along with a correction in the volumetric requirements for the north portion of the project results in a total beach nourishment requirement for the 50-year project life of about 74.6 million cubic yards. The previous volumetric requirement as presented in the feasibility report was about 79.0 million cubic yards.

**4.02.2 NMFS Comment:** The DEIS implies that this beach nourishment project will have minimal impacts on fisheries, but this conclusion is poorly supported. Few peer-reviewed field studies on short-term dredge and fill effects have been published and no studies of long-term effects are available. The utilization of nearshore areas to fishery resources, especially for larvae and juveniles, is becoming better documented. The effects to these sensitive life stages from sediment suspension, elevated turbidity, and modification of the nearshore area warrants better information, especially since the life of this project is 50 years.

**Corps Response:** The high quality of the sediment selected for beach fill and the small amount of beach affected at any point in time would not suggest that this activity poses a significant threat. The unknowns concerning the occurrence, distribution, and life history aspects of surf zone fishes and their sensitivity to beach disposal impacts suggest that further study is warranted, and some monitoring is justified. These uncertainties concern impacts of using an offshore borrow area, and impacts of beach disposal on sea turtles, larval and juvenile fishes, crab larvae, shorebirds, and surf zone invertebrates. The Corps will address these issues through the development of a monitoring plan as described in section 6.12.2 of the FEIS. Except for an offshore borrow area not being involved, a similar integrated monitoring plan for beach disposal actions on several beaches in Brunswick County, North Carolina is currently being coordinated and should be implemented in late 2000 and early 2001. Information gathered from this coordination and monitoring

effort will be helpful in the development of the monitoring plan for Dare County. Scientific knowledge on the impacts of beach disposal will be enhanced from these two monitoring efforts at the opposite ends of North Carolina's coastline.

It is expected that pertinent data from the Brunswick County study will be available prior to implementation of the proposed project, which is not scheduled to begin until 2004.

**4.02.3 NMFS Comment:** The DEIS describes the physical characteristics and benthic and pelagic species associated with the proposed offshore borrow sites NI and S1, but the importance of overwintering habitat for migrating fish in the vicinity of borrow site N1 is not adequately addressed. Species known to overwinter in this area include striped bass (*Morone saxatilis*), Atlantic sturgeon (*Acipenser oxyrinchus*), and weakfish (*Cynoscion regalis*). This area also is EFH for juvenile and adult summer flounder (*Paralichthys dentatus*) and spiny dogfish (*Squalus acanthias*), species managed by the MidAtlantic Fishery Management Council (MAFMC).

**Corps Response:** Disagree. See section 5.04.5 for Wintering Fishes and 5.04.2 and Table 5-3 for EFH species. These sections of the FEIS relate to all potential borrow sites, including N 1, N 2 and S 1.

**4.02.4 NMFS Comment:** The DEIS underestimates the potential impact of dredging at borrow site NI on overwintering habitat for migrating fish. An analysis of sediment data by the U.S. Fish and Wildlife Service (FWS) found that many of the sediment samples from site NI contain greater than 10 percent fines (silt and clay). Only by averaging was the site determined to meet the 90 percent sand criteria for beach nourishment. Dredging sediments with greater than 10 percent fines may result in suspended sediments loads and turbidity that exceed the levels predicted in the DEIS. Borrow site NI is located within an area where the above species concentrate in the winter months because of favorable habitat conditions. If the turbidity levels in these water are higher than predicted, avoidance reactions and/or a reduction in feeding efficiency due to poor visibility could be expected. These effects could reduce survival rates of fish subject to these conditions.

**Corps Response:** See response to USFWS comment 4.06.48 regarding the percent of fines in Borrow Area N1. The major factors influencing the strength of the turbidity or sediment resuspension source at the dredge are the sediment type being dredged, the dredge plant and manner in which it is operated, and ambient currents. If the sediment is primarily sand, material may be released to the water column, but it quickly settles out. If the material is primarily fine grained, it can remain in suspension for a longer period of time while being subjected to the processes of diffusion, settling, and transport. An approach for estimating the sediment mass released by a dredge was proposed by Nakai (1978). Nakai proposed a Turbidity Generation Unit (TGU) which is dependent on the volume rate of dredging and the dredged sediment particle diameter. Hydraulic cutterhead TGU's for sand with 1.5

% silt to sandy loam with 11.4 % silt were 0.3 kg /m<sup>3</sup> and 1.4 kg/m<sup>3</sup>, respectively. Maximum TGU values were about 45 kg /m<sup>3</sup> for sediment which is 35% slit and clay. These data support the position that differences in dredge-induced turbidity caused by the differences in sediment characteristics between borrow area N1 and the other borrow areas will not be significant. There will be a difference in turbidity generation between a 1 percent silt and 11 percent silt, but it is relatively small., Dredging within N1 is not expected to produce turbidity levels significantly higher than those for the other borrow areas.

Maximum suspended sediment concentrations generally remain less than 500 mg/L and bottom suspended plumes are limited to within 500 m of the hydraulic cutterhead dredge (Havis 1988; LaSalle 1990). For a hopper dredge, suspended sediment plumes may range up to 1,200 m on the bottom at concentrations up to 800 mg/L (LaSalle 1990). Surface concentrations are dependent on whether overflow is occurring. Motile organisms can generally avoid unsuitable conditions, particularly in the open or unrestricted ocean. Behavioral responses to the turbidity plume such as changes in foraging patterns and success will also be very localized to the dredging location if they occur at all. Under most scenarios, fish and other motile organisms encounter localized suspended sediment plumes for exposure durations of minutes to hours unless the organism is attracted to the plume and follows its location. The localization of the turbidity effects to the dredging site, the magnitude of the plumes, and the ability of motile organisms to avoid unsuitable conditions imply that reductions in fish survival rates are not likely occurrences.

Nakai, O. 1978. Turbidity generated by dredging projects, management of bottom sediments containing toxic substances. Proceedings of the third United States-Japan Experts Meeting, EPA-600/3-78-084.

Havis, R.N. 1988. Sediment Resuspension by Selected Dredges. Environmental Effects of Dredging Technical Note EEDP-09-2, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

LaSalle, M.W. 1990. Physical and Chemical Alterations Associated with Dredging, Proceedings, Workshop on the Effects of Dredging on Anadromous Pacific Coast Fishes, Seattle, Washington, September 8-9, 1988. C.A. Simenstad, ed. Washington Sea Grant Program, Seattle WA.

**4.02.5 NMFS Comment:** We also are concerned with potential impacts to striped bass, a species managed by the Atlantic States Marine Fisheries Commission. The DEIS states that the FWS analysis of Southeast Area Monitoring and Assessment Program trawls for striped bass between 1994 and 1997 indicated that the northern borrow site N1 (along with N2 which is not being used) had the highest catch per unit effort values for eight of the ten years for which data are compiled. The primary food source for striped bass within the project area was anchovies. Although anchovies are associated with the upper portion of the water column, turbidity generated by extensive dredging over the life of the project could disrupt sight feeding by striped

bass or cause forage species to avoid the project area. Restoration of the striped bass population to its current level involved the long-term conservation and management efforts by state and Federal resource and regulatory agencies. Therefore, measures should be described and implemented to avoid any adverse impact to striped bass populations.

**Corps Response:** See the response to comment 4.02.4 regarding turbidity effects. The turbidity effects will be localized to the dredging location. If they occur at all, behavioral responses to the turbidity plume such as changes in foraging patterns and success will also be very localized to the dredging location. Mobile organisms can avoid the plume, particularly in the open ocean. Accordingly, the probability of adverse effects to striped bass populations as a result of the proposed dredging is low.

**4.02.6 NMFS Comment:** The area of disposal site N1 is *EFH* for summer flounder and dogfish and these species also may experience stresses similar to those described for striped bass. Further, the nearshore area within the project boundaries is *EFH* for early life stages of red drum (*Sciaenops ocellatus*), managed by the South Atlantic Fisheries Management Council (SAFMC), summer flounder, and bluefish (*Pomatomus saltatrix*). In our specific comments, several ongoing studies are noted that will provide new information that should be considered before this beach nourishment project is initiated.

**Corps Response:** See the responses to comments 4.02.4 & 4.02.5.

**4.02.7 NMFS Comment:** NMFS believes that a more environmentally responsible plan for this project would be to eliminate dredging in site N1 by limiting all excavation of borrow material to borrow site S1 or another site with appropriate sand content and low fishery value. The DEIS should be revised to address the alternative(s) that avoid dredging in borrow site N1 and any other borrow sites located within the limits of the overwintering area for migratory fish populations.

**Corps Response:** An alternative that does not use N1 is evaluated in the FEIS, Section 3.04. Our evaluation of this alternative indicates that the increase in the first cost of the North project would be at least \$15,300,000 (from \$22,713,000 to \$38,000,000). With the addition of an associated \$2.4 million more in interest during construction, the benefit-to-cost ratio would decrease from 1.3 to 1.09. The proposal is not expected to provide a significant reduction in project impacts and therefore is not proposed.

**4.02.8 NMFS Comment:** Initiation of this project should be deferred until current studies, applicable to the nearshore areas of the project site, are completed and evaluated.

**Corps Response:** We do not plan to delay project implementation pending completion of the referenced studies. However, the aforementioned studies are

expected to begin in 2001. The proposed project is not scheduled for implementation until 2004. It is expected that pertinent data will be available from these studies prior to project implementation. Project specific impact monitoring (not included in the DEIS) is now proposed. See section 6.12.2 of the FEIS.

**4.02.9 NMFS Comment:** 1.02 Areas of Controversy Page 1-3, paragraph 2. NMFS does not agree that no known areas of controversy exists for this project and has previously raised questions regarding the impact of beach nourishment on early life history stages of fishery resources. Although the Corps of Engineers (COE) has recently committed to begin addressing this issue by agreeing to conduct studies of the impact of beach nourishment on the Brunswick County beaches, these studies have not been completed. Accordingly, this section should be revised to reflect that there still are unresolved issues regarding the impacts of beach nourishment on fishery resources.

**Corps Response:** Section 1.02, Areas of Controversy, has been revised to list all areas of controversy raised during the DEIS comment period, including impacts on fishery resources.

**4.02.10 NMFS Comment:** 3.02 Nonstructural Alternatives Page 3-1, paragraph 4. This paragraph refers to Federal guidelines on relocation plans as a basis for determining that nonstructural alternatives are not economically feasible. The DEIS should include a citation for the guidelines and more detail on the specific aspects of the guidelines that make the relocation of structures on the beach impractical.

**Corps Response:** Federal evacuation guidelines are found in ER-1105-2-100 (22 April 2000), Appendix E, pages E-90 through E-113, and specifically Table E-15, page E-103, illustrate benefit types that can and should be used. A more specific discussion of relocation benefit analysis can be found in IWR Report 88 R-2, National Economic Development Procedures Manual-Urban Flood Damage, March 1988. The non-structural section of the Economic Appendix, Appendix H, section 3.3.2, has been revised to more fully discuss the non-structural alternative.

**4.02.11 NMFS Comment:** 4.05 Periodic Nourishment Schedule, Page 4-7, Paragraph 3. This paragraph provides no supporting documentation for the presumption that material eroded from a nourished beach during storm events will work its way back onshore during fair weather conditions. Data and analyses to support this conclusion should be provided.

**Corps Response:** Post-storm recovery of an eroded beach profile is a well known phenomenon that is documented in the scientific literature. Beach profile data collected at the Corps of Engineers Field Research Facility located at Duck, North Carolina has documented this phenomenon since 1977. The beach profile monitoring data can be found in the annual data summaries. Also, several papers on nearshore profile response to storms and post-storm recovery were published in the Proceedings on Coastal Sediments 99. Finally, see page 1-13 of the Shore

Protection Manual, 4<sup>th</sup> Edition, U.S. Army Engineer Waterways Experiment Station, Coastal Engineering Research Center, U.S. Government Printing Office, Washington, D.C. 1984. In any event, in the formulation of the Dare County Beaches project, post-storm recovery of the project beach was only assumed for the position of the shoreline. Material eroded from the foreshore, that is above 0-feet NGVD, was cumulated over each 3-year cycle and the sum total of the storm erosion volume included in the subsequent nourishment operation along with volume losses associated with historic shoreline recession.

**4.02.12 NMFS Comment:** 6.01.2 Cumulative Impacts, Page-6-1. paragraph 4, Page 6-2. Table 6-1. Table 6-1 is intended to provide a summary of cumulative impacts of beach nourishment. However, this table does not include Bogue Banks and Onslow Beach, both of which are developing beach nourishment proposals, or the proposed nourishment of the Brunswick County beaches in association with the Wilmington Harbor Project. Also, the derivation of the 20.8 percent total (Column 5) of North Carolina beaches impacted by beach nourishment is unclear. Our calculations indicated a total of 24 percent. The calculations in this table should be examined to ensure that the DEIS provides the correct value.

**Corps Response:** Noted. The cumulative impacts analysis has been revised; see Section 6.11 of the Final EIS.

**4.02.13 NMFS Comment:** 6.01.3 Nearshore Ocean, Page 6-2. paragraph 3. Project-related impacts to overwintering migratory fish populations, especially striped bass, could be reduced by avoiding dredging activities in borrow site N1. The DEIS should be revised to address the alternative of limiting dredging to borrow site S1 or another site with a similar sand content and low fishery value. Based on information provided in the DEIS, a sufficient volume of material is available at S1, the use of which would preclude the need to dredge in overwintering areas for important fishery resources.

**Corps Response:** Disagree. See response to comment 4.02.7.

**4.02.14 NMFS Comment:** 6.04.1 Dredging Impacts, Page 6-7. paragraph 3. The DEIS provides no basis for the conclusion that beach nourishment activities within four miles of Oregon Inlet will not adversely impact larval fish recruitment into the inlet. Information provided in the DEIS indicates that larvae generally move at a right angle to the beach until they reach land fall, then parallel to the beach until they reach an inlet. We are unaware of data that indicate the distance larvae are capable of traveling parallel to the beach before they reach an inlet. Therefore, it is inappropriate to imply that larval fish losses four miles from the inlet are of no consequence.

**Corps Response:** See response to comment 4.02.2 above.

**4.02.15 NMFS Comment:** 6.04-12 Impacts on the Marine Water Column

Page 6-11, paragraph 4. We agree that scientific data on the effects of beach disposal in the surf zone on fishery resources are very limited. This paucity of data is the basis for our determination that impacts to EFH (Surf Zone) and the associated Federally managed species and their prey may be more than insignificant as indicated in the DEIS. The magnitude of the impact of beach disposal in the surf zone has yet to be determined and this uncertainty should be identified in the DEIS.

**Corps Response:** This uncertainty will be so noted in the FEIS Section 6.04.12. However, limited scientific data is not a firm basis to determine that impacts are more than insignificant.

**4.02.16 NMFS Comment:** 6.04.14 Impact Summary on Essential Fish Habitat

Page 6-12, paragraph 3. See our comments on 6.04.12 Impacts on the Marine Water Column above. Also, see EFH comments that follow.

**Corps Response:** This will be so noted in the FEIS Section 6.04.14

**4.02.17 NMFS Comment:** 6.11.1 Commitments, Page 6-22. We recommend that the list of commitments be revised to include the following: A commitment to limit dredging for borrow material to borrow site SI or another site with similar sand content and a low value to fishery resources.

**Corps Response:** Disagree. See response to comment 4.02.7.

**4.02.18 NMFS Comment:** A commitment to post-construction monitoring of all borrow sites. The details of this monitoring effort should be coordinated with the state and Federal resource agencies.

**Corps Response:** The Corps agrees to perform both pre- and post-construction monitoring. See response to comment 4.02.2 above.

**4.02.19 NMFS Comment:** 6.11.2 Mitigation, Page 6-23, paragraph 4. COE-funded monitoring of beach nourishment projects in Brunswick and New Hanover Counties should better define the impact of beach disposal on early life history stages of fishes and nursery area functions of the surf zone. A more acceptable approach for this project would be to defer any decision on mitigation for impacts to fishery resources until the above referenced studies are completed and evaluated against this project.

**Corps Response:** See response to comment 4.02.2 above.

**4.02.20 NMFS Comment:** Essential Fish Habitat Comments Transmittal of the DEIS initiated coordination procedures for EFH consultation pursuant to the MSFCMA. Based on our review of the DEIS we have determined that the EFH assessment

does not adequately address the project-related impact to Surf Zone (a subcategory of marine water column) and Marine Water Column EFH. The NMFS is convinced that dredging offshore for borrow material and the disposal of dredged material on the Dare County beaches would adversely impact EFH. Furthermore, insufficient information is available to reach a conclusion on the impacts of dredged material disposal on early life history stages of Federally managed species. Therefore, we do not concur with your conclusion that EFH impacts are minimal.

**Corps Response:** The NMFS has noted uncertainties regarding the magnitude of Surf Zone impacts, listed important fish species and specialized uses of the project area such as Nursery Area and Wintering Grounds, which are all acknowledged in our assessment. The NMFS has provided no data or explanation that would support non-concurrence with our conclusion.

**4.02.21 NMFS Comment:** Red drum, managed by the SAFMC, and summer flounder and bluefish, managed by the MAFMC use the surf zone in the project area as EFH. According to the DFR, about 17 miles of beaches incorporating about 600 acres of surf zone, will be periodically impacted by a total of 88.7-million cubic yards of dredged material during the 50-year life of the project. This incremental addition to the currently impacted shoreline described in Table 6.1 of the DEIS is significant and adds to the cumulative area of North Carolina shoreline impacted by beach nourishment on an annual basis. The COE recognizes that limited information is available on the impacts of beach nourishment on early life history stages of fishes. However, the DFR concludes that neither the three years required to construct the project nor the 50-year maintenance plan will result in significant impacts. Studies recently funded by the COE will examine the impacts of beach nourishment on early life history stages, of fishes as a part of the Wilmington Harbor Improvement Project. Also, the COE's Engineering Research and Development Center (ERDC), possibly in cooperation with the National Ocean Service, Center for Coastal Fisheries and Habitat Research, will soon conduct studies of the effects of various levels of turbidity on larval fishes at the ERDC Field Research Facility at Duck in Currituck County, North Carolina. In spite of the fact that these studies may clarify the impacts of the disposal of dredged material in the surf zone, the DEIS makes no commitment to defer action on the proposed project until appropriate studies are completed and the results evaluated.

**Corps Response:** The number of cubic yards required for the 50-year life of the project was reported to be 79,000,000 million cubic yards (Table D-8 of the draft feasibility report and EIS). As explained in response to NMFS comment 4.02.1, the total volume requirements for the 50-year life of the project have been reduced to about 74.6 million cubic yards. See Section 6.01 regarding Cumulative Impacts. See response to comment 4.02.2 above regarding monitoring and deferral of the proposed action.

**4.02.22 NMFS Comment:** We also are concerned that borrow site NI is located in an important overwintering area for juvenile and adult summer flounder and spiny



dogfish, species managed by the MAFMC. Over the 50-year life of the project, up to 800 acres of habitat that supports these species would be altered. As noted under our General Comments, suspended sediment levels may be greater than predicted as a result of dredging in borrow site N1. If elevated turbidity levels in borrow site N1 result in avoidance of prime overwintering habitat or a reduction in feeding efficiency, the EFH value of the area for summer flounder and spiny dogfish would be reduced. The DEIS therefore underestimates the potential impact dredging at borrow site N1 on overwintering habitat for migratory fish populations that represent the primary brood stock for these species.

**Corps Response:** See the responses to comments 4.02.4 and 4.02.5 regarding turbidity effects. The turbidity plumes produced will be localized to the dredge location and will not result in adverse impacts to migratory fish populations. The surface area of N1 that is proposed for use (300 acres), is a very small portion of a much larger geographic area, that extends from about Nova Scotia to Cape Hatteras, North Carolina and is considered wintering grounds for these species (See attached seasonal distribution maps from NMFS Essential Fish Habitat Source Documents for spiny dogfish and summer flounder). While we agree that these species may be present, we are not aware of data that suggests any particular affinity to N1 by spiny dogfish or summer flounder. Considering the distribution of these species, the use of N1 as borrow site does not represent a substantial threat to spiny dogfish or summer flounder populations.

**4.02.23 NMFS Comment:** In view of the above, the NMFS offers the following recommendations.

**4.02.24 NMFS Comment:** EFH Recommendations

Implementation of the project should be delayed pending completion of the studies to be funded by the Wilmington District and the ERDC. Completion of these studies will provide new information on the impact of beach nourishment in nearshore areas on early life history stages of Federally managed species.

**Corps Response:** See response to comment 4.02.2 above.

**4.02.25 NMFS Comment:** To minimize the direct and indirect impact of turbidity, the COE should ensure that the project does not use any sediment which consists of more than 10 percent silt or clay particles.

**Corps Response:** See the responses to comments 4.02.4 and 4.02.5 regarding turbidity effects. The sediment at all of the proposed borrow sites is primarily sand. Based on the estimated strength of the turbidity or sediment resuspension source differences in dredge-induced turbidity caused by the differences in sediment characteristics between borrow area N1 and the other borrow areas will not be significant. Dredging within N1 is not expected to produce turbidity levels significantly higher than those for the other borrow areas.

**4.02.26 NMFS Comment:** The project plans described in the DEIS should be revised to avoid impacts to overwintering habitat for the Federally managed spiny dogfish and summer flounder by eliminating dredging in site NI and limiting dredging for borrow material to site SI or another site with similar sand content and low fishery value.

**Corps Response:** See response to comment 4.02.7.

**4.02 U.S. Department of Commerce, Office of the Under Secretary for Oceans and Atmosphere, National Geodetic Survey (NGS), letter dated August 3, 2000**

**4.03.1 NGS Comment:** The subject statement has been reviewed within the areas of the National Ocean Service's (NOS) responsibility and expertise and in terms of the impact of the proposed actions on NOS activities and projects.

**Corps Response:** Noted.

**4.03.2 NGS Comment:** All available geodetic control information about horizontal and vertical geodetic control monuments in the subject area is contained on the National Geodetic Survey (NGS) home page at the following Internet World Wide Web address: <http://www.ngs.noaa.gov>. After entering the NGS home page, please access the topic "Products and Services" and then access the menu item "Data Sheet." This menu item will allow you to directly access geodetic control monument information from the NGS database for the subject area project. This information should be reviewed for identifying the location and designation of any geodetic control monuments that may be affected by the proposed project.

**Corps Response:** We will access the data NGS database to confirm that no NGS monuments will be disturbed by the project.

**4.03.3 NGS Comment:** If there are any planned activities which will disturb or destroy these monuments, NGS requires not less than 90 days' notification in advance of such activities in order to plan for their relocation. NGS recommends that funding for this project includes the cost of any relocation(s) required.

**Corps Response:** We do not anticipate that any NGS monuments will be impacted by the project. However, in the event a monument is disturbed, the Corps will fully comply with NGS reporting requirements and the project will assume financial responsibility for their replacement. No line item for this activity will be included in the project cost estimate as this and similar matters are considered to be contingency items.

**4.03.4 NGS Comment:** For further information about these geodetic monuments, please contact Rick Yorczyk; NOAA, NOS, National Geodetic Survey, N/NGS;

SSMC3 8636, 1315 East West Highway; Silver Spring, Maryland 20910; telephone: 301-713-3230 x142; fax: 301-713-4175.

**Corps Response:** Noted.

**4.03.5 NGS Comment:** Regarding the potential impact on NOAA's nautical charts, the recommended plan will not directly or significantly affect the safety of navigation. However, any shoreline changes should be reflected on nautical charts. NOS would like U.S. Army Corps of Engineers blueprints of this project upon completion so that any related changes can be accurately detailed on future editions of affected NOS charts.

For further information about these charting activities, please contact Howard Danley; NOAA, NOS, Office of Coast survey, N/CS28; SSMC3 7458; 1315 East West Highway; Silver Spring, Maryland 20910; telephone: (301)713-2732 xl05.

**Corps Response:** A commitment to provide as built plans to NOAA upon completion will be added to section 6.12.1

**4.04 Atlantic States Marine Fisheries Commission (ASMFC), letter dated August 23, 2000.**

**4.04.1 ASMFC Comment:** We appreciate the opportunity to comment on the Feasibility Report and Draft Environmental Impact Statement (DEIS) on Hurricane Protection and Beach Erosion Control in Dare County, North Carolina. The Atlantic States Marine Fisheries Commission, comprised of the fifteen Atlantic Coastal States and chartered by Congress in 1942, collectively manages the fishery resources in state waters along the Atlantic Coast.

**Corps Response:** Noted.

**4.04.2 ASMFC Comment:** We are particularly concerned with this proposed beach nourishment project because of the potential negative impacts on many of our managed species including striped bass, summer flounder, spiny dogfish, weakfish, and Atlantic Sturgeon. The proposed borrow site is important habitat for these species. According to survey work in the area, this site serves as striped bass wintering grounds, as well as spiny dogfish and summer flounder nursery areas. Tagging studies have indicated that fish found in this area are from North Carolina as well as farther north along the coast to Maine.

**Corps Response:** See response to 4.02.22

**4.04.3 ASMFC Comment:** Withdrawing sand from the proposed borrow site (S I) for fifty years as outlined in the DEIS could have significant impacts on these important fish stocks. Because of the huge volume of sand proposed for removal, the project could permanently alter the physical structure of the bottom. This project could

severely impact the area's benthic community, which could negatively impact the prey organism species composition, distribution, and abundance patterns. While we are aware of evidence which indicates that the benthos may repopulate an area after sand is removed, because the pumping of sand will continue annually for fifty years, we firmly believe that this project could permanently alter the food chain dynamics of the area.

**Corps Response:** Cumulative impacts on fishery resources are discussed in Section 6.11 of the Final EIS.

**4.04.4 ASMFC Comment:** While the draft EIS touched on some of our concerns, the document did not adequately address them. There is no discussion of the economic costs of lost revenues from project impacts on the commercial and recreational fishing industries in the area. There is more marine sport fishing in Dare County than in any other area of North Carolina. Many of the tourists mentioned in the report are sport fishermen and this project could negatively impact the fish and fishing opportunities available to them.

**Corps Response:** The DEIS section 6.04.3 describes potential impacts to commercial and recreational fisheries. These impacts are believed to be primarily inconvenience to sport and commercial fishermen involving minimal associated costs. In most cases, avoidance of the dredge operation and pipeline would not involve additional cost. Therefore, an attempt to measure the costs associated with these impacts for inclusion in the economics of the project was not made.

**4.04.5 ASMFC Comment:** The draft EIS mentions that the project could affect many of our managed species but there is not adequate discussion of the magnitude of the environmental or economic impacts. In addition, we are aware that many beach nourishment projects are proposed on the Atlantic Coast and feel the cumulative impacts of all these projects on fishery resources should be addressed.

**Corps Response:** We have expanded our discussion and analysis of cumulative impacts to fishery resources. Please see Section 6.11. in the Final EIS.

**4.04.6 ASMFC Comment:** We are currently in the process of updating many of our interstate fishery management plans. These updated plans will include a habitat source document outlining the habitat needs of the species and habitat areas of particular concern. We anticipate striped bass, summer flounder, spiny dogfish, and Atlantic Sturgeon to be completed within the next year. We will provide this information to the Army Corps of Engineers and would expect this information to be taken into account in the future planning for this project.

**Corps Response:** Thank You. We welcome any information that we can use to better understand the impacts of our activities or use to reduce those impacts.

**4.05 U.S. Environmental Protection Agency, Region IV (USEPA), letter dated August 29, 2000**

**4.05.1 USEPA Comment:** Pursuant to Section 309 of the Clean Air Act and Section 102(2)(C) of the National Environmental Policy Act (NEPA), EPA, Region 4, has reviewed the subject document, an evaluation of the environmental consequences of long-term sand emplacement on approximately 16 miles of eroding shoreface. The proposed nourishment is divided into two reaches, viz., North Project Area encompassing Kitty Hawk and Kill Devil Hills and a South Project Area encompassing Nags Head and Cape Hatteras National Seashore. Two offshore borrow areas comprising approximately 7 square miles will be mined for the necessary sand during the project's life span. Given the magnitude of the initial project construction coupled with the desire to reduce mobilization costs, it was deemed necessary to void the seasonal dredging restrictions usually operative for nourishment projects. Since the time window in which dredging occurs is so important to mitigating environmental losses (especially turtle nesting), the consequences of this decision will be more definitively examined via consultation with the U.S. Fish and Wildlife Service (USFWS). Specific measures by which this matter is resolved should be discussed in the final EIS.

**Corps Response:** See response to NMFS comment 4.02.1 for revised project lengths and 50-year volumetric requirements. The Corps recognizes the risks and costs of performing dredging work outside of the normal dredging window and has proposed the current project schedule only because it believes it to be in the overall public interest. We will work with the U.S. Fish and Wildlife Service to minimize project impacts to the maximum extent practicable.

**4.05.2 USEPA Comment:** The Wilmington District (District) has committed to a project alternative which is conceptually in conflict with recent decisions made by the State of North Carolina and the Outer Banks Erosion Task Force, together with the past Land Use Plans for the local communities involved. Each of these entities is on record as having serious reservations about the adverse environmental ramifications of routinely applying a beach nourishment solution to all shore line erosion problems.

**Corps Response:** The Wilmington District has participated in the activities of the Outer Banks Erosion Task Force since its inception in 1993. The District also has a representative on the Outer Banks Science Panel appointed by the North Carolina Department of Transportation (NCDOT) to provide scientific and engineering guidance to the Task Force. The purpose of the Task Force is to develop a long-term plan to preserve the NC 12 transportation corridor along the Outer Banks. To that end, the Task Force formulated a plan of study that would consider all alternatives including beach nourishment. This study was initiated this year and is being conducted under the auspices of the Dare County Beaches authorization. The scope of the study will include all of the Outer Banks south of Oregon Inlet to Ocracoke Inlet. We are not aware of any position taken by the Task Force that would preclude beach nourishment as a viable option. As is the case for all the

alternatives, beach nourishment will be evaluated for its engineering feasibility, cost effectiveness, and environmental consequences.

NCDOT and the Outer Banks Erosion Task Force along with other Federal, State, and local agencies and private interest groups, have considered various options for protecting an erosion "hot spot" situated between Avon and Buxton on Hatteras Island for a period not to exceed 10 years. Due to the short duration of the protection period and the high cost associated with beach nourishment relative to the other feasible alternatives, the NCDOT Science Panel did not favor beach nourishment as a short-term solution for this particular site. However, this recommendation does not apply to the feasibility study being conducted for the long-term protection of the entire NC 12 corridor, nor does it apply to this project. The feasibility of beach nourishment as a long-term solution for all of the erosion "hot spots" will be evaluated on a case-by-case basis and will be weighed against other options developed for these areas.

With regard to local land use plans, the study for protecting the Dare County shoreline north of Oregon Inlet is sponsored by Dare County and has the full support of the County and all of the incorporated towns in the study area. While some communities may have previously supported alternative management approaches, including relocation and retreat, the support by the local entities for the current study demonstrates that they are not tied to this past management practice and are seeking alternative measures that would be in the overall best interest of the area.

**4.05.3 USEPA Comment:** In an immediately related matter, the DEIS has some procedural shortcomings in that of the three planning objectives listed on page 2-2; viz., (a) Reduce the adverse effects of hurricanes and northeasters including flooding and erosion, considering nonstructural, structural, and no Federal Action alternatives; (b) Avoid or minimize impacts to natural resources, including beach invertebrates, marine fish, sea birds, and marine mammals; and (c) Protect endangered and threatened species, only reduction of property damage from storms is given an adequate examination. Given that the entire analysis immediately follows from what a proposal seeks to produce, this matter should be addressed in greater detail the final document.

**Corps Response:** We disagree that only reduction of storm damages was adequately examined. Throughout planning for the proposed project we have attempted to minimize impacts to the environment and listed species. Examples would be choosing the least environmentally damaging borrow site (all estuarine sites and hardbottom areas avoided), timing construction and maintenance to reduce impacts to the maximum extent practicable, and using endangered species observers and nest relocation when needed. In addition, some structural measures such as groin fields and seawalls were not examined in detail because of their high environmental costs. We believe we have made every reasonable effort to address each of these planning objectives.

**4.05.4 USEPA Comment:** Our specific comments on this proposal directly track those already provided in the USFWS Coordination Report and by the overview given in the presentation by Dr. Robert Dolan. The concerns raised by these commentors about the environmental, geotechnical, and societal ramifications of this extensive nourishment plan were explored by the District. While each of their major subject matter areas received a response, we do not agree with many of the conclusions drawn in this regard by the District about the lack of any adverse long-term environmental impacts resulting from this proposal, whether the federal interest will provide a real long-term solution to the current erosion situation, and/or address (or even lessen) the potential for ever increasing real estate (societal) losses.

**Corps Response:** Noted.

**USEPA Comment:** The idea that there are sufficient resources (sand, financial, or otherwise) to protect all eroding shorelines within the District's boundaries via a beach nourishment/dune construction solution needs to be explored more definitively in the final document.

**Corps Response:** The DEIS only addresses sand resources necessary to protect the project area over the next 50 years. In this regard, sufficient beach compatible material has been identified for this purpose. With respect to other areas within the State that are vying for coastal storm damage reduction projects, the first order of business for each area will be the search for and identification of suitable sand resources to support a project for at least 50 years. We know that in certain areas of the State, sufficient sand resources may not be available to support large-scale projects such as the one being recommended for Dare County. In these areas, management of the coastal erosion problem and the prevention of storm damages will focus on better management of the limited sand resources in the area that are being trapped in tidal inlets, navigation channels, or in natural shoals.

Analysis shows that sand resources in the area are adequate to construct and maintain the recommended project. As for financial resources, when a Corps district is tasked with studying the feasibility of erosion control measures for a given beach, whether or not the project will be funded is not part of the evaluation at the District level. Congress will decide that issue. Financial constraints of the local sponsor, however is a consideration at the District level. In the case of Dare County Beaches, the Wilmington District believes that the sponsor is willing and capable of meeting its financial commitment for the recommended project.

**4.05.6 USEPA Comment:** Moreover, there should be an evaluation of the environmental consequences of the cumulative impacts of the initial construction coupled with the repetitive episodes on both the receiving and borrow sites.

**Corps Response:** The cumulative impacts analysis has been expanded, see section 6.11 of the Final EIS.

**4.05.7 USEPA Comment:** Further, it should also be made clear to the decision maker(s) for this project that the protection attendant to this sand redistribution is only operative for relatively minor storm events. In fact, larger, admittedly less frequent, storms would completely subsume any protection provided by the project, but would destroy the intensified development engendered by a false sense of protection.

**Corps Response:** Disagree. The Wilmington District has two beach nourishment projects that have been in operation since 1965, one at Wrightsville Beach and the other at Carolina Beach. Construction of a third storm damage reduction project, known as the Kure Beach project (located immediately south of Carolina Beach), was completed in February 1998. Since 1996, the Carolina Beach and Wrightsville Beach projects have been exposed to Hurricanes Bertha and Fran in 1996; Hurricane Bonnie in 1998; and Hurricanes Dennis and Floyd in 1999. Three of these storms, Bertha, Fran, and Bonnie passed directly over the project areas.

Hurricane Fran, which hit the area in September 1996, was the most severe of all of the recent storms and produced high water levels comparable to the previous storm of record, Hurricane Hazel of October 1954. Both the Wrightsville Beach and Carolina Beach projects survived the combined effects of Hurricanes Bertha and Fran in 1996 without any serious damage to the majority of the artificial berm and dune. Furthermore, the projects prevented major damage to ocean front development while other affected beach communities located along Topsail Island and the pre-project area of Kure Beach suffered major structural damage and structure loss. A draft report on the differences in the impacts of these storms on the protected and unprotected coastal communities, which was prepared by the Corps of Engineers Institute for Water Resources, was published in June 2000 with the final report scheduled for publication later this year. This report fully documents the protective value provided by the Wrightsville Beach and Carolina Beach projects.

Hurricane Bonnie struck the area in July 1998, or just a few months following the completion of the Kure Beach project. Hurricane Bonnie produced no damage along the ocean front of Kure Beach and no damage to the older projects at Wrightsville Beach and Carolina Beach. The actual performance of these projects during these recent storms clearly demonstrates and confirms their ability to prevent damage due to coastal storms as well as eliminate damages associated with long-term erosion trends.

The recommended project would provide some degree of protection (i.e., lowering damages) to all but the most catastrophic of storms—perhaps a category 5 hurricane. The Corps does not agree that beach nourishment projects lead to an intensification of development. History shows that the intensification comes with or without a project.



**4.05.8 USEPA Comment:** We continue to believe that the need for routine maintenance to sustain these beach projects underestimates the direct, indirect, and cumulative impacts on the biological resources which are permanently destroyed in the process of sand manipulation. Since our perspectives regarding the overall merits of beach nourishment continue to be so divergent from that of the District, it would be helpful to have a meeting of the state/federal stakeholders involved with these type projects to discuss their ramifications.

**Corps Response:** The Wilmington District Corps of Engineers would invite any interested agency, individual or group that would like to meet for discussions regarding the Dare County Beaches (Bodie Island Portion) Feasibility Report and Environmental Impact Statement during the public comment period to contact the project manager, Sharon Haggett at (910) 251-4441 as early as possible. The District will work to accommodate all reasonable requests with a one-on-one meeting with the requesting organization to be conducted in the Wilmington District offices at 69 Darlington Avenue, Wilmington, North Carolina.

**4.05.9 USEPA Comment:** We have assigned this particular project a rating of EC-2. That is, we have pronounced environmental concerns about the election of maintaining a given amount of beach in a specific location in a high energy marine environment given the magnitude of processes working contrary to this objective. Additional information derived from an interagency meeting would more definitively frame those areas of agreement/disagreement in this regard. The results of this dialogue should be included in the final EIS.

**Corps Response:** The District has fully coordinated this project with all interested agencies, both through the scoping process and through agency review of the DEIS. We believe that the areas of agreement/disagreement are clear. As indicated in response to comment 4.05.8, above, we will be happy to discuss the project with any agency representatives who wish to contact us through the project manager. We do not, however, intend to host an interagency meeting for that purpose with regard to this particular project.

**4.06 U.S. Department of the Interior, Fish and Wildlife Service (USFWS), National Park Service (NPS), and U.S. Geological Service (USGS), letter dated September 14, 2000**

**4.06.1 USFWS Comment:** The Department of the Interior has reviewed the Draft Feasibility Report and EIS on Hurricane Protection and Beach Erosion Control, Dare County Beaches (Bodie Island Portion), Dare County, North Carolina, Vol. 1, as requested.

**Corps Response:** Noted.

**4.06.2 USFWS Comment:** The U. S. Fish and Wildlife Service, the National Park Service, and the U.S. Geological Survey provided comments which are enclosed as

northern area of 3.01 miles and a southern area of 9.53 miles) was economically justified. These areas would be protected by constructing an artificial dune at 13 feet above the National Geodetic Vertical Datum (NGVD), approximately mean sea level, behind an artificial berm (subaerial beach) 50 feet wide. The two disjunct placement areas, totally 12.54 miles, would have a 3,000-foot transitional area at each end of the main fill. The four transition areas would add 12,000 feet (2.27 miles) to the disposal area, for an overall project length of approximately 14.8 miles. Initial project construction would require 12,480,000 cubic yards of sand. Renourishment would require 4,160,000 cubic yards of sand with each segment being renourished every three years. The official life of the project is 50 years. Sand would be taken from one northern (N1) and one southern (S1) borrow areas located offshore in water beyond the -30 foot NGVD contour line, but within the 3-mile limit of state-controlled waters. The two borrow sites cover approximately seven square miles. Material would be collected by pipeline or hopper dredges and moved by pipeline to the beaches. The pipeline would be routed along the ocean shoreline.

**Corps Response:** See response to NMFS comment 4.02.1 for revised project lengths and 50-year volumetric requirements.

**4.06.4 USFWS Comment:** These comments are submitted in accordance with the Fish and Wildlife Coordination Act (FWCA) (48 Stat. 401, as amended; 16 U.S.C. 661-667d) and Section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531-1543). These comments do not constitute the report of the Secretary of the Interior as required by Section 2(b) of the FWCA. The Fish and Wildlife Service (Service) provided a Draft FWCA Report (U. S. Fish and Wildlife Service [hereafter USFWS] 1999) to the Wilmington District, U. S. Army Corps of Engineers. The Service plans to provide a Final FWCA Report in conjunction with the Biological Opinion in mid-November, 2000.

**Corps Response:** Noted.

consequences, including the possibility of a significant risk of creating serious environmental degradation. Mistakes are also extremely costly to undo.

**Corps Response:** Noted.

**4.06.8 USFWS Comment:** The Service has reviewed the DFR and DEIS and presents four important ideas for consideration. These ideas arise from the mission of the Service to conserve, protect and enhance fish and wildlife and their habitat.

**First,** beaches and marine areas, both nearshore and offshore, are important habitat for many important fish and wildlife resources. The Service presented information on the existing fish and wildlife resources of the project area (USFWS 1999). The Comment (DEIS, p. 2-2) expresses concern for the "high value resources in the project area." The beaches are heavily used by migrating shorebirds (DEIS, p. 5-2). Marine waters in the vicinity of potential beach nourishment areas and offshore borrow sites provide habitat for a variety of ocean fish (DEIS, p. 5-6). The intertidal zone within

**FEIS Attachment C-23**

greater development. The initial placement of sand creates an impression of permanency for beachfront structures. Based on the perception of permanency, larger and more expensive structures are built. When the initial sand placement washes away, the value of property in danger is greater and greater funds can be justified for additional sand placements. However, this loop cannot continue indefinitely. At some point the availability of affordable sand, or sand at any price, will end. By that time, the level of development will have increased to the point that policy of letting nature take its course would result in staggering economic losses. The only remaining option will be a seawall that would rapidly lead to the destruction of the beach. The structures will be saved, but all habitat values of the beach will vanish. There is emerging evidence for this beach loss scenario today. Dean (1998, p. 119) writes that Miami Beach, Florida, an area nourished since 1977, has a beach so inhospitable to small beach creatures and the birds that feed on them that the beach is quiet and "bereft of life."

#### **FEIS Attachment C-24**

the proposed beach disposal area serves as habitat for invertebrates that provide an important food source for surf-feeding fish and shorebirds (DEIS, p. 5-7). Sea turtles use the project area beaches for nesting (DEIS, p. 5-23). Project area habitats are a significantly important resource both regionally and nationally.

**Corps Response:** Noted.

**4.06.9 USFWS Comment: Second,** the large scale dredging and sand placement associated with constructing and maintaining artificial beaches and dunes create both short-term and long-term adverse environmental impacts on these resources. The Corps states (DFR, p. 85) that some adverse environmental impacts are anticipated. Section 10 of the Service's Fish and Wildlife Coordination Act Report discussed the likely impacts of the proposed construction (USFWS 1999, pp 115-131).

**Corps Response:** Noted.

**4.06.10 USFWS Comment: Third,** from a long-term perspective of a hundred years or more, static beachfront development cannot coexist with the habitat values of a natural beach. The Corps states (DEIS, p. 8-11) that continued development in the project area will occur with or without the project. The Service believes that future development in the absence of an artificially maintained berm-dune system would be fundamentally different from that which would occur if natural forces are not allowed to dominate the area. Without the commitment for an artificial berm-dune system, beachfront lots would not be viewed as permanent. There would be a recognition that the beach would continue to recede landward. Such a recognition would surely influence the type and level of development. Development would be more modest and perhaps built to allow for periodic retreats from the ocean. The creation of an artificial berm-dune system creates a positive feedback loop in which ever greater property values demand ever greater expenditures for protection that leads to greater development. The initial placement of sand creates an impression of permanency for beachfront structures. Based on the perception of permanency, larger and more expensive structures are built. When the initial sand placement washes away, the value of property in danger is greater and greater funds can be justified for additional sand placements. However, this loop cannot continue indefinitely. At some point the availability of affordable sand, or sand at any price, will end. By that time, the level of development will have increased to the point that a policy of letting nature take its course would result in staggering economic losses. The only remaining option will be a seawall that would rapidly lead to the destruction of the beach. The structures will be saved, but all habitat values of the beach will vanish. There is emerging evidence for this beach loss scenario today. Dean (1999, p. 119) writes that Miami Beach, Florida, an area nourished since 1977, has a beach so inhospitable to small beach creatures and the birds that feed on them that the beach is quiet and "bereft of life."

**Corps Response:** The various scenarios listed above are purely speculative. The Corps is not aware of any definitive studies that support the assertions that beach nourishment projects induce development. In response to an Office of Management and Budget directive, the Corps of Engineers, under the auspices of the Water Resources Support Center, Institute for Water Resources, conducted a study of its shore protection program and evaluated the possible relationship between beach development and coastal protection projects. The final report was published in June 1996 as IWR Report 96-PS entitled "An Analysis of the Corps of Engineers Shore Protection Program." Chapter 6 of that report, which was prepared by economic consultants from George Washington University, specifically addresses the induced development issue. The conclusions of that study were:

**"Conclusion:** Corps projects have been found to have no measurable effect on development, and it appears that Corps activity has little effect on the relocation and/or construction decision of developers, homeowners, or housing investors."

The entire coast of North Carolina has undergone tremendous development during the last two decades, for the most part, in the absence of beach nourishment. There are only three storm damage reduction projects in the State, Wrightsville Beach, Carolina Beach, and Kure Beach. Wrightsville Beach and Carolina Beach were both constructed in 1965 while Kure Beach was completed in 1998. These three projects only cover approximately 9.8 miles of the North Carolina coast. All three of these storm damage reduction projects were constructed along areas that were essentially fully developed at the time of their construction. In this regard, the requirements for Federal participation in coastal storm damage reduction projects essentially dictate that these projects be constructed along areas that have a high degree of development. That is, in order for the Federal Government to cost share in 65 percent of the initial construction of the project, at least 50 percent of the project's benefits must be for storm damage reduction. Over the years, some improvements have been made in the character of the development in Wrightsville Beach and Carolina Beach, however, the overall density has not been significantly changed. Furthermore, the character of the new structures at Carolina Beach and Wrightsville Beach is not unlike the structures being constructed in unprotected areas. The replacement structures must meet modern building codes which are more stringent than the ones in place when the original structures were built. As a result, the replacement structures are more resistant to wind and flood damage.

Even if beach protection projects were preferred for development over unprotected areas, structures protected by these projects are subject to less risk and less damage than structures located in unprotected areas. This was graphically demonstrated in Hurricane Fran as damage to ocean front development at Wrightsville Beach and Carolina Beach due to ocean waves and storm surge was minimal compared to the damage experienced by neighboring unprotected beaches.

**4.06.11 USFWS Comment:** Fourth, the Service would accept a decision to follow a course of creating an artificial berm-dune system if all the social, economic, and environmental consequences of the various alternatives for reducing storm damage are completely developed and analyzed. However, any failure to fully comply with the letter and spirit of NEPA raises serious concerns about the legal foundation of an alternative selected for implementation.

**Corps Response:** CEQ regulations require that the Corps explore and evaluate all "reasonable alternatives, and for alternatives which were eliminated from detailed study, briefly discuss the reasons for their having been eliminated." 40 CFR Section 1502.14(a). Neither the letter nor the spirit of NEPA requires the Corps to fully evaluate all alternatives to a proposed action; only alternatives that are reasonable or feasible need be evaluated in detail. The Corps expanded the documentation of its findings concerning the non-structural alternative in both Appendix H and the Alternatives Section of the Final EIS. The treatment of alternatives in these documents complies with both the spirit and the intent of NEPA.

**4.06.12 USFWS Comment:** The Service believes that documents prepared under NEPA benefit from a clear distinction between the "need" for federal action and the "purpose" for the project under consideration. This distinction assists decision makers and the public to fully understand the alternatives being presented and ultimately leads to a better informed decision. While these two aspects are often discussed concurrently, these comments discuss each separately.

**Corps Response:** Noted.

**4.06.13 USFWS Comment:** A need expressed during project planning should be a well-defined problem. Furthermore, the problem should not be stated in a manner, which points to a single solution. The DEIS states (p. 2-1) that the Dare County beaches need shore protection. The DFR (p. 9) also indicates that shore protection is a suitable federal objective. Neither of the broad statements of need specifically mention the beneficiaries of the protection sought. Shore protection is later divided into two components: (1) reduction in damage caused by major coastal storms; and, (2) the control of beach erosion, the steady reduction in the distance between the ocean and fixed structures.

**Corps Response:** The problem is hurricane and storm damage and beach erosion. Hurricane and storm damage reduction and beach erosion control are considered to be benefits to the nation. These benefits, referred to as National Economic Development (NED) benefits, are used in evaluating the economic feasibility of the various alternatives considered and also used for selecting the NED plan. The NED plan is the plan that maximizes the net average annual benefits.

**4.06.14 USFWS Comment:** The DFR (pp. 24-29) presents a thorough history of the devastating storms that have impacted the project area, and notes that hurricanes and storms can sweep away entire structures. The Service recognizes this need.

The need to control the distance between fixed structures and the ocean during non-storm conditions is more complicated. Local interests have expressed a need for beach erosion control since (DFR, pp. 8-9) "[a] severe erosion problem exists in much" of the 20-mile project area. This problem is later linked to "damages", but without specifying what had been damaged (DFF, p. 10). The DFR later states (p. 14) that the problem of beach erosion refers to long-term shoreline recession rather than the rapid recession that occurs during storms, and that this problem threatens structures located just upland of the shoreline. By 2054, progressive long-term erosion is expected to have "claimed more than 1,000 structures ... and to have also washed out NC [highway] 12 in Kitty Hawk." (DFR, p. 23).

**Corps Response:** Structures and lands have been damaged by hurricanes and storms as well as by beach erosion. Erosion consists of rapid shoreline retreat due to hurricane and storm action and also long term erosion due to shore processes. This shoreline retreat, if unabated, will result in damages to structures and lands located adjacent to the ocean shoreline. If left unprotected, structures will also be damaged by wave overwash from hurricanes and storms.

**4.06.15 USFWS Comment:** The Corps seeks to equate shoreline recession with inland erosion where the natural hydrologic cycle does indeed transport sediment completely out of the area from where water first picks up material. Sediment picked up in inland mountains can in theory be carried to the sea. Inland erosion can produce a permanent lost of land. The Corps states (DFF, p. 14) that "... land losses to progressive erosion are essentially permanent." The situation on Atlantic barrier islands is completely different. The barrier islands are surrounded by water that has been rising for five to eight thousand years (Inman and Dolan, 1989; USFWS, 1999, pp. 6,9). Dean (1999, p. 34) writes that the Intergovernment Panel on Climate Change, a United Nations organization, anticipates the sea level to rise by one to three feet by the middle of the 21<sup>st</sup> century. If barrier islands could be destroyed by the type of "erosion" suggested by the Corps, they would have disappeared thousands of years ago. The reason that barrier islands still exist is they move landward toward higher ground in response to rising seas (see Figures 3 and 5, USFWS 1999). The barrier islands stay pretty much the same size, but occur in a different location.

**Corps Response:** Based on the geologic record of sea level rise, sea level rose at an extremely rapid rate from 20 thousand years before present to 6 thousand years before present. The rate of rise during this 15 thousand year period was 0.8 meters/century (Department of Energy 1988). Over the last 6 thousand years, the geologic record indicates that sea level has slowed to 0.08 meters/century (Department of Energy 1988). The geologic record also indicates that the modern day barrier islands are approximately 5 to 6 thousand years old. Based on this geologic record, barrier island migration was probably active during the period of rapid rise in sea level (20 thousand to 6 thousand years before present) but slowed or ceased when the rate of sea level rise decreased 6 thousand years ago.



Comparative analysis of barrier island changes dating from the mid 1800's to the mid 1940's indicate that the barrier islands did not migrate during this 75 year period. The Wilmington District compared detailed maps of the barrier islands from Rodanthe south to Beaufort Inlet as well as Masonboro Island, located along the southern portion of the North Carolina coast. The comparative analysis determined changes in the ocean shoreline position, changes in the sound shoreline position, and changes in the marsh vegetation line over the approximately 75 year period. Note that the marsh vegetation line is the line that separates the upland areas of the barrier islands from the soundside marsh. This particular time period was selected for analysis as it did not include significant impacts of the artificial dune building program on Hatteras and Ocracoke Islands that began in the mid to late 1930's. The general findings of this analysis are reported in the Phase II General Design Memorandum for the Manteo (Shallowbag) Bay project (also known as the Oregon Inlet project) as well as in Shore and Beach (publication of the American Beach Preservation Association). The study found that all of the barrier islands, including Core and Shackleford Banks which were not included in the dune building program, are experiencing general erosion on both the ocean and sound sides. Also, the marsh vegetation line generally moved seaward. These measured changes were deemed to be consistent with changes one would expect as a result of a 0.75 to 1.0 foot rise in sea level during the analysis period. The only area exhibiting classic barrier island retreat characteristics was the east end of Ocracoke Island which "rolled over" in response to a sediment deficit created by the opening of Hatteras Inlet in 1846. The general findings of the Wilmington District study were verified by subsequent work of Everts, Battley, and Gibson in a report entitled "Shoreline Movement" which was published as a Coastal Engineering Research Center Technical Report TR CERC-83-1. Everts, et al also found that the islands from Virginia Beach south to Cape Hatteras were eroding on both the ocean and sound side.

Recently, Dr. Stan Riggs of East Carolina University, has put forth a new theory regarding the future of the barrier islands that appears to agree with the historic changes that have taken place over the last 150 years. Dr. Riggs hypothesizes that the islands will gradually erode and become so narrow that the advent of a category 4 or 5 hurricane in the next 20 to 30 years will breach the islands in several places, resulting in a series of islands from Oregon Inlet south to Cape Hatteras. While we do not necessarily agree with the timing of Dr. Riggs' predictions, Dr. Riggs apparently recognizes the threat that ocean and sound side erosion poses to the barrier islands. His predictions are not unlike what occurred to the Isles Dernieres off the Louisiana coast between 1978 and 1983 (Department of Energy 1988) in which the island responded to an accelerated rate of relative sea level rise by deteriorating into a series of 5 small islands.

In summary, while barrier island migration apparently played a major role in the development of the present-day barrier island system, the geologic record does not provide any indication that this process is continuing or having any influence of the present physical make-up of the barrier islands. The overwash episodes that have

occurred during the last 150 years have rarely penetrated beyond the sound side shoreline. Most overwash episodes resulted in sediment deposition either on the upland portion of the islands or just beyond the marsh line defined above. Accordingly, barrier island migration and/or rollover is not considered to be a significant factor in the management of the barrier islands over the next 50 to 100 years.

(Department of Energy, Workshop on Sea Level Rise and Coastal Processes, Office of Energy Research, Office of Basic Energy Sciences, Carbon Dioxide Research Division, DOE/NBB-0088, Palm Coast, Florida, March 9-11, 1988. )

**4.06.16 USFWS Comment:** One natural process that allows the islands to survive is the movement of sand from the ocean front over the island to the back, or sound, side. This process is called island overwash. However, this natural mechanism for island survival has been diminished in the project area. Artificial shoreline dunes hinder the island overwash process. Ironically, the DFR (pp. 14, 24, 37) states that erosion has removed much of a "natural protective dune system" in the project area. Characterizing shoreline dunes in the project area as "natural" is incorrect since shoreline dunes were made by the Civilian Conservation Corps in the 1930s. Dean (1999, p. 62-63) writes that:

"... the entire string of barrier islands that stretches its narrow way from the Virginia border past Cape Hatteras to Ocracoke is fronted by a sea wall. It looks like a sand dune but it is a wall just the same, built by the Civilian Conservation Corps in a project started during the Depression.... and its aim was to improve the Bank's economy by holding off the sea and allowing the construction and preservation of a paved road."

The issues associated with the man-made dune reflect the feedback loop mentioned earlier. Dune construction in the 1930s facilitated the existing development which can now be used to justify larger, more costly measures to protect structures since the initial dune is being eliminated by natural forces.

**Corps Response:** See responses to 4.06.15 and 4.06.10. We concur the dune is not natural.

**4.06.17 USFWS Comment:** When the process of island migration is considered, the Corps is wrong in assuming that long-term ocean processes are destroying the barrier islands. Some sand that is prevented from moving to the back side of the island eventually goes back out to sea, and may ultimately be lost to the barrier island ecosystem. Sand moved inland by smaller storms is pushed back to the beach and may also be lost. This is the real threat to the long-term survival of the barrier islands.

**Corps Response:** See response to 4.06.15.

**4.06.18 USFWS Comment:** The Corps should redefine the need, which is now designated as "beach erosion control" and give a more accurate assessment of exactly what is needed. The Corps should acknowledge that the sea level is rising and that barrier islands adjust to this rise by moving landward. The westward movement of the shoreline is not due to erosion analogous to that occurring inland, but is simply an adjustment to rising sea level. The Service will use the term shoreline adjustment to refer to the movement of the shoreline. However, the Corps refers (DFR, p. 30) to progressive beach erosion due to long-term shore processes as a problem. If the Corps considers the shoreline adjustment associated with island migration to be a problem, that position should be clearly defined and stated.

**Corps Response:** The definition of erode, as given in Webster's Dictionary, is as follows:

"1: to diminish or destroy by degrees: a: to eat into or away by slow destruction of substance:...b: to wear away by action of water, wind..."

As discussed in the response to USFWS comment 4.06.15, the barrier islands are losing land mass as a result of wave action, storm activity, and sea level rise encroaching from both the ocean and sound sides of the islands. This loss of land mass is by definition, erosion. There is no evidence that the modern day barrier islands are undergoing any wholesale movement toward the mainland or maintaining the same physical makeup.

**4.06.19 USFWS Comment:** Regarding the needs within the project area, the Service recommends that the Corps clarify the relationship between reducing damage to structures and shoreline stabilization, i.e., beach erosion control. If the Corps seeks to stabilize the shoreline for reasons other than reducing property damage, the rationale for seeking shoreline stabilization independent of damage reduction should be explained. If shoreline stabilization is sought to reduce damage to structures, it is redundant to mention it in addition to damage reduction. This clarification is requested because the DEIS notes (p. 8-3) that non-structural plans can be beneficial at reducing some types of damage, but would not halt shoreline recession which is a concern of the project's sponsor. This statement suggests that shoreline stabilization is sought for reasons other than reduction in property damage.

**Corps Response:** The problem is hurricane and storm damage and beach erosion. The Recommended Plan of Improvement is a beach nourishment project consisting of a berm and dune. This plan will reduce future hurricane and storm damages as well as provide for beach erosion control for structures and lands located adjacent to the ocean shoreline.

**4.06.20 USFWS Comment:** An important issue related to needs in the project area is the continued existence of the recreational beach. Table 4-3 of the DEIS indicates that the no action alternative will result in the "continued deterioration of the existing beach." The DFR (p. 34) notes that "[t]he recreational beach that remains by 2004 is

expected to be very narrow or nonexistent at high tide." There is a fundamental, unstated assumption in this position that beachfront structures must remain in their present position. On the other hand, geologists contend that natural, coastal processes do not destroy barrier island beaches. As with the barrier islands themselves, if the ocean destroyed the beaches, they would have disappeared thousands of years ago. In North Carolina, Core Banks, an undisturbed barrier island which was spared the artificial dune building of the 1930s, has a beautiful, wide beach that has never been nourished. When natural processes are allowed to operate, wide natural beaches will continue to exist.

**Corps Response:** The issue is not whether there would be a beach but whether there would be a useable beach. A beach littered with failed structures, septic tanks, previous protection works such as sandbag revetments, and other infrastructure certainly is not very inviting to the recreating public.

**4.06.21 USFWS Comment:** The real reason for the shrinking recreational beach in the project area is that it is trapped between fixed man-made structures to the west and a rising sea to the east. The artificial dunes block most attempts for natural processes to move the beach to higher ground. As noted above, the artificial dune has acted like a seawall. Seawalls have invariably led to the disappearance of natural beaches (Pilkey and Dixon 1996, p. 40). Storms that carry sand landward as overwash fans are actually creating a beach properly positioned for the current level of the ocean. The overwash fan is a higher and wider beach, but unfortunately beachfront property owners do not want the beach landward of their property. Earth moving equipment is brought in and the new beach is picked up and moved back to the rising shoreline.

**Corps Response:** As discussed in response to comment 4.06.15, the Corps disagrees that barrier island migration is an active process affecting modern day Outer Banks. The barrier islands were not migrating prior to the construction of the artificial dunes. Also, Core Banks, which was not included in the dune building program, has also experienced erosion on both the ocean and sound side over the last 150 years with very little overwash penetration occurring across the entire width of the island.

**4.06.22 USFWS Comment:** The Service is also concerned that constructing artificial beaches is often presented as the only way to save a recreational beach. This is clearly a false argument. The real issue is not whether barrier islands will have recreational beaches, but where these beaches will be located. Powerful hydrologic and geologic forces are trying to move the beaches to higher ground as the sea level rises. Beachfront property owners want the beach in front of their homes, not under or behind them. A truly impartial observer might conclude that it is the beachfront property owners that are destroying the recreational beaches by pushing the sand back into the sea every time an ocean overwash moves the beach landward. If the fact of barrier island migration was widely accepted, recreational facilities would adapt and tourists would continue to enjoy the beaches with little regard for the fact

that the beach moved a few yards every year. Overall, the preservation of recreational beaches and the tourist economy which they support provides no justification for constructing artificial beaches.

**Corps Response:** See responses to comments 4.06.15 through 4.06.21.

**4.06.23 USFWS Comment:** The Service has concerns about the Corps' stated need to "control beach erosion." This position seems to imply that shoreline adjustment on an undeveloped barrier island, such as Core Banks, is just as harmful to national interests as shoreline adjustment at Kitty Hawk. Such a position totally ignores the fact that shorelines on undeveloped islands can adjust to a rising sea and maintain a beautiful wide beach. If this control is directed at the natural survival processes of the barrier islands, the long term consequences would be extremely detrimental for the project area.

**Corps Response:** See responses to comments 4.06.15 through 4.06.22. Again, Core Banks has experienced both ocean and sound side recession of its shorelines and loss of land mass just like the other barrier islands in North Carolina. While the absence of a well defined or vegetated dune line may give the appearance of a wide beach, the fact is, Core Banks is much narrower today than it was 150 years ago.

**4.06.24 USFWS Comment:** The Service believes that the present need statement is deficient in that there is no clear explanation of why protection is needed for the three weakest hurricane classes, with storm surges up to 12 feet (see USFWS 1999, p. 84), and none is proposed for the two strongest classes, with storm surges over 13 feet. Defining storm intensity for which protection is desired is important even if the total funds available for the project are unknown. The fact that certain financial, social, or logistical factors may ultimately define the level of protection should not be considered in this section of the NEPA document. This definition reflects the purpose of the project and is used in developing alternatives. The actual goal such as protection against hurricanes in categories 1-2 or even protection against a severe category five storm (winds over 155 mph and a storm surge over 18 feet) may not be achieved by the project ultimately approved and funded, but this definition sets the project purpose as required by the NEPA. While funding constraints may not allow the stated project goal to be achieved, the potential level of funding is irrelevant to goals that are sought. Actual funding will dictate the degree to which desired goals are obtained, but should not influence the goals themselves.

**Corps Response:** Storm still water levels used in the formulation of the Dare County Beaches project were based on stage-frequency curves developed by the Federal Emergency Management Agency (FEMA). According to FEMA, a storm expected to occur only once in 500 years (500-year storm) would produce a storm surge of 11.7 feet above NGVD. The maximum storm of record for the area, the Ash Wednesday Storm of 1962, only produced a still water level of 8.0 feet above NGVD. The Corps is not aware of any published or accepted stage frequency curves for the area that show a storm surge of 18 feet for a 100- to 500-year storm.

The plan formulation process for the Dare County Beaches project did not target any particular storm. The plan was formulated based on optimizing the difference between the cost of providing a certain protection plan and the damage reduction associated with that plan for a whole suite of storms with return frequencies ranging from 1 year to 500 years. If as stated in the comment a category 5 hurricane would produce a storm surge of 18 feet, the frequency of such a storm surge would be so rare as to not affect the selection of the plan of protection. Again, the recommended plan is not intended to eliminate all damages but to reduce damages to an acceptable and economic level.

**4.06.25 USFWS Comment:** The planning documents do not mention any need to reduce damage from storm waves and flooding coming from the sound. In fact, the DFR (p. 75) notes that project plans have no provisions to protect the area against storm tide flooding occurring from increased water levels in the estuary backing the barrier island. Pilkey et al (1998, p. 37) present an excellent diagram showing that as hurricanes move north along the Atlantic coast, the initial storm winds blow landward, creating the dangerous storm surge from the ocean. However, after the eye of the storm moves north of a given point, the wind direction changes and storm winds blow toward the ocean. These latter winds create the ebb surge that can carry water from the sound over the island. The Service has discussed this ebb storm surge (USFWS 1999, p. 90) and presented a diagram (USFWS 1999, p. 91, Figure 14) showing that every type of storm damage that occurs on the coast can also occur on the sound side of the island. County officials recognize that sound side areas are susceptible to flooding and the impact of wind driven waves during hurricanes and other weather events (Dare County 1994, p. 23). The back side of barrier islands need as much attention for storm damage reduction as the ocean side. Bush et al. 1996, pp. 31-32, state that "A mighty fortress (e.g., a seawall) is worthless if the attack comes from the rear." A beachfront home directly behind the primary dune can be completely flooded and pounded by waves associated with the storm surge coming from the sound.

**Corps Response:** While sound side flooding does occur, these floods are not accompanied by waves of sufficient height to cause structural damage to properties located along the oceanfront. Most properties located along the sound shorelines are private and access to the sound beaches is restricted, which prevents Corps participation in protection of these beaches. The plan formulation analysis for the Dare County Beaches project includes a certain amount of residual damage that would not be prevented by the project. Included in these residual damages are those caused by sound side floods and waters entering the project area from the flanks.

**4.06.26 USFWS Comment:** The Service considers the present need statement deficient in that only storm damage resulting from wave attacks coming from the ocean appear to require protective action. We wonder whether property owners will truly benefit if structures are protected from ocean wave attack only to be flooded by

waves coming from the sound. This is a critical element in project planning since project needs lead to the project purpose, which ultimately, determines the alternatives to be considered.

**Corps Response:** See response to comment 4.06.25.

**4.06.27 USFWS Comment:** With regard to need, the Service does not understand why the Corps does not simply say that man-made structures within the project area have been, and in the future are certain to be, damaged by coastal storms and shoreline adjustment to a rising sea. While such a clear and direct statement begs the question of why the structures were built in such a hazardous location, we believe this is the most accurate statement of need. We believe that the project need should not separate the control of shoreline adjustment from damage to structures. Shoreline adjustment is a completely natural, continuous response of a barrier island to rising sea level, and it is only a source of concern when fixed structures have been built too close to the ocean.

**Corps Response:** Disagree. Most of the structures that are presently vulnerable to damage associated with a continuation of historic shoreline recession and storms were initially constructed well back of the shoreline. Structures constructed since the passage of the Coastal Area Management Act have to adhere to State mandated set back requirements. Over the years, the progressive erosion of the shoreline has continued, placing these structures in their current vulnerable state. With regard to the statement of need, Congress directed the Corps to study beach erosion control, as well as hurricane protection and storm damage reduction.

**4.06.28 USFWS Comment:** Under the planning process mandated by NEPA, the stated need sets the stage for the purpose of federal action. The August 1, 1990, Congressional Resolution requested the Corps to study the Dare County beaches "... in the interest of beach erosion control, hurricane protection, storm damage reduction, and related purposes." While the resolution mentions several goals, the overall statement can be reduced to protection of existing structures in the project area from storms and shoreline adjustment.

**Corps Response:** We believe the language of the resolution speaks for itself.

**4.06.29 USFWS Comment: Purpose of Storm Damage Reduction -** The Service recommended (USFWS 1999, p. 150). That the Corps provide specific information on the level of storm, the type(s) of storm damage, and the locations within the project area for which protection from storm damage is sought.

The planning documents fail to specify the level of storm for which protection is sought. The DFR (p. 29) does not appear to consider variation in storm magnitude in the project propose, but speaks generically of "hurricane-wave attack" as a mathematical probability. The main body of the DEIS (pp. 2-1) is also vague on the magnitude of storms for which protection is sought. The only real clues to this aspect

of project planning appear in the Corps' response to the Service's FWCA Report recommendations. The DEIS (p. 8-3) notes that "plans are not targeted at any particular high or low intensity storm and would not totally eliminate damage from severe storms." The DEIS also states (p. 8-2):

"Beach nourishment projects are no longer formulated according to meeting a desired level of protection. Rather the project dimensions are optimized based on the project size yielding the largest net benefit. Using a 50-year life cycle approach, the beaches are subjected to a randomly generated group of storms. The project dimension yielding the biggest spread between benefits and costs is the NED [National Economic Development] Plan."

This explanation is extremely confusing and is not understandable to decision makers and the public. Rather than stating a clear level of protection desired and working forward to design a project, the Corps seems to have estimated the available sand and money and worked backward to design the structure that produced the largest benefits possible for a 50 year planning scenario. The Corps should have examined the basic features of hurricanes such as those given by Pilkey et al. (1998, p. 23). These authors note that the characteristic storm surges for hurricanes in categories 1 through 5 are 4-5, 6-8, 9-12, 13-18, and more than 18 feet, respectively. These data indicate that hurricanes in categories 4 and 5 would easily pass over the proposed 13-foot artificial dune. The project would provide little, if any, real protection against the two strongest classes of hurricanes. The planning documents fail to explain why the project purpose is limited to the three smallest hurricane classes and leaves the project area completely vulnerable to the two strongest classes. Clearly the project as proposed will not protect the public against all possible storm damage. The types of storms for which protection would be provided seem to be a critical element of the project purpose.

**Corps Response:** The explanation of the plan formulation process previously provided follows the current guidance for not only coastal storm damage reduction projects but projects for reducing damages due to river flooding. The Corps is required to develop a plan that results in the maximum difference between its costs and the benefits it would generate. This plan is known as the National Economic Development Plan (NED Plan). The NED Plan sets the limits of Federal cost for the project. If the non-Federal sponsor desired greater protection, the non-Federal sponsor would be responsible for all cost in excess of the NED plan. If the USFWS is still confused about this standard plan formulation procedure, the Corps would be glad to meet with USFWS personnel to provide detailed explanations of the methodology.

**4.06.30 USFWS Comment:** References to the types of storm damage for which protection would be provided are vague and scattered through the documents. The DFR states (p. 75) that the selected plan of improvement provides for storm protection only in terms of protecting development from the action of ocean storm surge and wave action. The DEIS (p. 2-2) merely speaks of reducing the adverse



effects of hurricanes and northeasters. The DFR (p. 24) also notes that "[w]hen the island is under hurricane and storm attack, the full force of waves is felt along the immediate ocean shoreline; as the waves break and spill over the ocean edge of the island, development in upland areas is subject to the force of the waves." The clearest statement of damage prevention is given later in the DFR (p. 33) when economic benefits are expected to accrue by reduced inundation and undermining by erosion during hurricanes and northeasters. The project purpose appears to ignore flooding from the sound (flooding by the storm surge ebb), flooding due to heavy rain, and real extent to which inundation and scouring during storms will be reduced. As noted, the DFR states (p. 75) that "[t]here are no provisions in the project to protect the area against storm-tide flooding occurring from increased water levels in the estuary backing the barrier island."

**Corps Response:** See response to 4.06.25

**4.06.31 USFWS Comment:** The actual area to be protected is not clearly given in the DFR or the DEIS. The Service discussed (USFWS 1999, p. 90) the different zones of flood hazard used by the National Flood Insurance Program (NFIP). On the coast there are V-zones that can expect flooding with waves of three feet or higher, the most dangerous area. There is an A-zone that would experience flooding with waves of less than three feet. An artificial berm and dune may have only limited success in controlling basic flooding since the storm surge ebb, heavy rains, and ocean surges passing around the ends of the project may inundate large areas. Therefore, protection would result primarily in the V-zone where there would be some reduction in wave height. Since wave heights would naturally diminish as they move inland, the actual area to be protected would be a strip of land along the coast. This area should be defined and mapped as part of the project purpose.

**Corps Response:** The project would reduce damages to ocean front development (that is structures located within the first two to three rows of the ocean) due to long-term or historic erosion, storm induced erosion, direct wave impact on the structures, and some flood damage associated with storm waves overwashing the frontal dunes. These project outputs are clearly defined in the DEIS. No attempt is made to reduce flooding due to rainfall or sound side storm surges. Also, see response to USFWS comment 4.06.25.

**4.06.32 USFWS Comment: Purpose of Beach Erosion Control -** Beach erosion control has been an inconsistent feature of the project. The January 1993 Reconnaissance Report did describe the project as a hurricane protection and beach erosion control project (U. S. Army Corps of Engineers [hereafter USACOE] 1993). However, the Corps request for scoping comments of July 1, 1997, describes the project as a hurricane and storm damage reduction project. The Notice of Intent to prepare the DEIS which appeared in the Federal Register on July 23, 1997, also described the work as a hurricane and storm damage project with no mention of controlling beach erosion. The current DEIS has reinstated beach erosion control as part of the project purpose. The return to the original dual project purpose

is significant. The DEIS notes (p. 3-1) that nonstructural alternatives may reduce storm damage, but do not inhibit erosion. With erosion control back in as a primary project purpose, a nonstructural alternative is much easier to dismiss.

The Service believes that the Corps exaggerated the ability of the project to control the natural recession of the beach. The DFR states (p. 24) that "... the most effective solution for the beach erosion problems along the Primary Study Area would be a beach berm project." The efficacy of which the Corps speaks does not refer to controlling shoreline adjustment, but instead refers to preventing the land underneath existing structures from being washed away. A more accurate statement of project purpose would be the use of a temporary sediment barrier to save beachfront structures. In a geological sense, shoreline adjustment cannot be controlled. Placing sand on the beach does not "control" erosion, but merely constructs a sacrificial barrier that is fully expected to disappear, or erode, under the existing conditions before it is replaced and the process starts over again.

**Corps Response:** The Water Resources Development Act of 1986(WRDA 1986) recognizes two types of beach projects, namely; storm damage reduction and recreation. The Federal Government can pay up to 65 percent of the first cost of construction a coastal storm damage reduction project and 50 percent of the first cost for a recreation project. Cost sharing for periodic nourishment of both types of project is 50 percent Federal and 50 percent non-Federal. While WRDA 1986 only recognizes storm damage reduction, WRDA 1986 stipulates that the prevention of damages caused by beach erosion be included as a storm damage reduction benefit.

The initial construction of a coastal storm damage reduction project and its associated periodic nourishment, can provide erosion protection for a number of years. For example, the Wrightsville Beach and Carolina Beach projects have been in existence for over 35 years and both have been successful in maintaining the ocean shoreline 150 to 200 feet seaward of where it was in 1964. In this regard, the artificial beaches created by the coastal storm damage reduction projects are expected to lose sediment over a period of time. Accordingly, all of these type projects include periodic nourishment to replace loss sediment and maintain the protective value of the project.

**4.06.33 USFWS Comment:** The Service recommends that the Corps revise and clarify the project purpose. If the project seeks comprehensive storm protection over a wide area, then the details mentioned in these comments must be addressed. If the goals of protection are limited in scope, these limitations should be clarified in the stated purpose for both decisionmakers and the public. Since the artificial berm and dune system will not "control" shoreline adjustment, the project purpose should be restated to reflect the real desire to preserve the area on which beachfront structures have been built.

**Corps Response:** The project purpose is to reduce damages associated with hurricane and storm events and beach erosion, which includes damages to structures and land. The project purpose has been clearly stated.

**4.06.34 USFWS Comment:** The project purpose should set the stage for developing the widest range of alternatives. The Service recommended (USFWS 1999, p. 150) that NEPA documents present the entire range of alternatives to achieve the desired level of storm damage reduction. The DEIS (pp. 3-1 to 3-2) does consider three broad approaches: (1) no action; (2) non-structural alternatives; and, (3) structural alternatives. The non-structural alternatives include relocation of oceanfront structures, strict zoning and set back requirements, retrofitting existing buildings, and stricter building codes for new buildings. The Service is pleased that these options were developed it is the Corps handling and evaluation of these alternatives that are suspect. These measures were discussed by the Service (USFWS 1999, pp. 83-105).

**Corps Response:** Noted.

**4.06.35 USFWS Comment:** The selection of a preferred alternative should be a thoughtful balancing of achieving the project purpose and minimizing adverse environmental impacts to the greatest extent possible. However, early project planning equates storm damage reduction with beach nourishment. The Corps' Reconnaissance Report (USACOE 1993) seems to assume that any effort to reduce storm damage would be a beach nourishment project. While discussing the area without a federal project, the report notes that local governments would not be able to implement a full-scale beach nourishment project by themselves (USACOE 1993, p. 13). The discussion of environmental considerations focuses exclusively on constructing and maintaining an artificial berm and dune system (USACOE 1993, pp.14-15).

The Service recommended (USFWS 1999, p. 150) that NEPA documents discuss the factors that led to selecting the preferred alternative. After summarizing the problems in the project area, the DFR (p. 10) swiftly reaches the conclusion that "[t]he only technically feasible solution identified in this study consisted of berm and dune construction to arrest erosion and protect against wave action." After a more detailed discussion of storm damage and shoreline adjustment, the report again finds (DFR, p. 30) that "[t]he most effective measure to address these needs appears to be a berm and dune project . . . "

The DEIS makes a better attempt to evaluate possible alternatives. While the Service prefers that alternative development and evaluation be separated, the no action alternative and non-structural alternatives are each introduced, evaluated, and eliminated in two paragraphs. We do not believe the Corps has followed the NEPA implementing regulations regarding alternative analysis. CEQ's implementing regulations, as found in CFR 1502.14, state the development of alternatives should be the "heart of the environmental statement" and that the discussion of alternatives

should "sharply define the issues and provide a clear basis for choice among the alternatives". It is apparent from the limited discussion of any but the selected alternative that the Corps did not take its formulation and evaluation of alternatives seriously.

**Corps Response:** See response to comment 4.06.11, above.

**4.06.36 USFWS Comment: Evaluation of the No Action Alternative -** The DFR considers (p. 30) the consequences of a no action alternative. This section notes that storm damage would continue in the project area. A course of no federal action is also examined in Table 17 (DFR, pp. 93-97). This table notes (p. 96) that both the artificial beach alternative and the no action alternative would have no beneficial contribution to environmental quality. The Service disagrees. The no action alternative would avoid 50 years of offshore dredging and sand placement on the beach. The absence of these actions would benefit all fish and wildlife resources in the action area.

**Corps Response:** Every alternative is measured against the future without a project scenario. We concur that the no action alternative would avoid all the impacts associated with beach nourishment, but that would be measuring it against the future with the project scenario.

**4.06.37 USFWS Comment:** Table 17 also states (DFR, p. 96) that a course of no action would lead to a "[c]ontinued loss of aesthetic values of oceanfront as erosion intrudes upon development." While damaged structures would be unsightly, these structures could be dismantled or relocated in a fairly short time period. Without a major federal commitment to perpetually maintain an artificial berm and dune system (the no action option), the former homesites would be replaced by an undeveloped beach. While beauty and aesthetic values may be in the eye of the beholder, the Service questions whether the replacement of mile upon mile of beachfront homes with a natural beach would really represent a loss of aesthetic values. If the Corps has survey data supporting the aesthetic superiority of beachfront structures over the natural, unspoiled beach, such data should be provided.

**Corps Response:** We agree that most people would consider an undeveloped beach more aesthetically pleasing than a developed beach with a shoreline protection project. We further agree that these structures "could" be removed in a short time period. However, experience indicates that this does not usually happen and is, therefore, not a reasonable expectation under a no action scenario. Moreover, once the existing oceanfront homes are removed, the project area would still not be an undeveloped beach. Homes occur in too many rows for the area to become totally undeveloped during the 50-year planning horizon. The area includes development across the entire island that will eventually fall victim to a continuation of the historic shoreline changes and storm impacts. Accordingly, under the no action alternative, the beach will continually be littered with damaged or failed structures, failed protection measures, and other anthropological debris.

**4.06.38 USFWS Comment: Evaluation of Relocation and Other Non-structural Alternatives** - The Corps provides only eight sentences in the DEIS (pp. 3-1/2) as its analysis of a non-structural alternative. The reader is provided scant information on the non-structural plans considered by the Corps. The only non-structural approach mentioned is the relocation, presumably within a single, short time frame, of "all the oceanfront structures along the same boundaries as the recommended project." There is no discussion of the damage reduction benefits that would be provided by other non-structural approaches such as the imposition of strict zoning and setback requirements, retrofitting existing buildings and stricter building codes for new buildings. Although some information regarding the development of the costs for this alternative is contained in the documents' appendices, the only information provided in the DEIS is a statement that the cost for relocating all oceanfront structures within the proposed projects' boundaries is about 3 00 million dollars. The Service again recommends that the Corps seriously evaluate a phased non-structural alternative which would employ sequential abandonment/retreat as a feature, along with the other measures which would likely greatly reduce future structural damage from hurricanes and other storms. The relocation option should not be viewed as one-time movement of every structure on the shoreline, but rather as a phased withdrawal in which some structures would be relocated and others purchased and dismantled.

**Corps Response:** See revised sections 3.3.2 of Appendix H and 3.02 of the DEIS for discussion of non-structural plans. Also, see response to comment 4.06.11. The idea of phasing a relocation or evacuation plan in over time in accordance with the rate of long-term erosion would not change the ultimate economic outcome. Granted the costs would be lower than implementing a non-structural plan over a single, short time frame, but benefits would also have to be discounted. There would be no protection from storm damages for a structure while waiting for the phased time to move. Consequently, many structures would suffer the same fate as with a no action alternative. In addition, with erosion rates as high as ten feet per year in some sections of the project area, relocation plans would involve more than moving the first couple of rows of structures in some areas to achieve the same level of protection provided by the proposed plan. The Corps has provided a beach nourishment plan that can be implemented to realize benefits relatively soon. Comparable plans should be consistent with the beach nourishment plan in terms of timing. Finally, whether a non-structural plan is phased or not, the plan does not address the loss of property to erosion, and lacks funding and social support.

**4.06.39 USFWS Comment:** The DFR mentions (p. 42) that "[n]onstructural" measures were also considered as required by Federal planning regulations. These measures usually include relocation, elevation, or waterproofing of buildings to reduce damageability. The only non-structural measure that would substantially reduce damages in the project area is structure relocation." The DFR then notes that "federal guidelines on relocation plans" seldom make these efforts economically feasible and that many large structures along the oceanfront are physically

impractical to move. Based on this analysis, relocation was not considered a practicable alternative. In only four sentences non-structural alternatives are introduced and eliminated. In the following section on alternative plans, the DFR (p. 42) notes that "[t]he alternative plans evaluated in detail were beach berm plans... and berm and dune plans."

**Corps Response:** See response to comment 4.06.11.

**4.06.40 USFWS Comment:** The Corps appears to reject the relocation option on four grounds. First, many large structures along the oceanfront are physically impractical to move (DFR, p. 42). Second, the environmental consequences of finding new sites for relocated structures and the associated infrastructure would harm the remaining natural resources of the barrier island (DEIS, p. 3-2). Third, relocating structures does not stop shoreline adjustment which from the Corps' perspective would eventually eliminate the recreational beach (DEIS, p. 3-1). Fourth, relocating all the oceanfront structure threatened by shoreline adjustment would be prohibitively expensive (DFR, p. 42; DEIS p. 3-2).

**Corps Response:** Noted.

**4.06.41 USFWS Comment:** The Service believes there are factors which the Corps has not fully considered in eliminating the non-structural alternatives. First, large structures can be relocated. In 1888 the large Brighton Beach Hotel on Coney Island, New York, was moved back 2,000 feet from the shoreline by six steam locomotives (Pilkey and Dixon 1998, p. 51). More recently and closer to the project area, the Cape Hatteras Lighthouse was moved back 2,900 feet from a precarious position near the ocean. This lighthouse is 200 feet tall and weighs approximately 2,800 tons. The lighthouse was successfully relocated between June and October 1999 and survived a brush with Hurricane Dennis. A Cape Hatteras National Seashore web page (<http://www.nps.gov/caha/moving.htm>) noted that "[m]oving great weights has become easier with the development of hydraulic technologies, and within the last five years, three lighthouses along the New England coast have been moved to reduce the threat of collapse into the sea." While the Cape Hatteras Lighthouse did not have to contend with avoiding other existing structures, the technology exists to move most, if not all, structures on the oceanfront of the project area back from the sea.

**Corps Response:** See response to comment 4.06.11. Given sufficient time, money, and available alternate sites, it may be possible to relocate any building. We note that the National Park Service web page states that the cost of moving the lighthouse was \$12 million.

**4.06.42 USFWS Comment:** There is no reason to eliminate the relocation alternative due to environmental impacts at the relocation site. The Corps notes (DEIS, p. 8-11) that "continued development will occur with or without the proposed project [beach nourishment]." The relocation of existing beachfront structures is not

likely to take land that would otherwise remain undeveloped. Any land suitable for development will be developed and this argument is not a valid reason for eliminating the relocation alternative. The environmental consequences of a non-structural approach would have been easier to evaluate if the Corps had included this option in Table 17 of the DFR, Summary of Plan Effects. However, this table considered only constructing the berm and dune system along with the no action alternative.

**Corps Response:** The Corps has not attempted to fully quantify all potential environmental effects of the relocation alternative, as we have found that it is not a reasonable alternative. We have noted, however, that there are environmental consequences to moving over 1,000 structures, including immediate development of the area into lots ready to accept the structures and their attendant features, including roads and utilities. This requirement would create a demand for developable lots over and above the normal rate of demand. The physical process of moving such a large number of structures also carries some risk of environmental damage.

**4.06.43 USFWS Comment:** The Corps' assertion that a relocation alternative does not reduce long-term erosion (DEIS, p. 1-1) implies that the option of relocating structures should be eliminated because beach "erosion" would continue to destroy the recreational beach. The Service has pointed out that natural processes cause the shoreline to adjust landward as sea level rises. No alternative can truly control the consequences of a rising sea. The relocation alternative would allow the shoreline to naturally move landward while all alternatives for constructing artificial barriers, including the artificial berm and dune system, would simply force water levels higher on the structural barrier. The fundamental difference between structural and non-structural alternatives is not whether there will be a recreational beach, but where that beach will be located.

Table 4-3 (DEIS, after p. 4-8) presents interesting comparisons between the artificial berm and dune system and relocation alternatives. Some positive characteristics of the relocation alternative would be to: (1) provide a more remote, undisturbed beach; (2) eliminate the need for future protection structures; and, (3) create a more natural appearance along the beach. The major negatives given in the table are: (1) displaced beachfront homeowners; (2) a reduce tax base; and, (3) the expectation that costs would exceed benefits. The last point raises the question of whether the Corps did a complete and reasonable analysis of the cost for a relocation option. Overall, the advantages of the relocation option are primarily environmental and the disadvantages are primarily social and economic. These comparisons should have been presented in Table 17 of the DFR, but that "Summary of Plan Effects" considered only the artificial berm and dune system and the no action plan.

**Corps Response:** Disagree. See response to USFWS comment 4.06.11.

**4.06.44 USFWS Comment:** The Service fails to see how the Corps analysis (DFR, p. 42) of a non-structural alternative can be considered thorough and complete. The analysis is cursory and the option is summarily dismissed from further consideration. The Service recommends that the Corps fully develop and analyze for consideration by their decisionmakers, the public, reviewers and local project sponsors a non-structural alternative which employs a more cost-effective abandonment/retreat approach that would be phased in over many years, rather than the all-at-once relocation alternative which was apparently the basis of the Corps perfunctory analysis. Use of such an approach by the project sponsors would place the burden of dealing with beach recession on individual, beachfront property owners, rather than the broader community of local residents and non-resident taxpayers whose federal taxes will be employed to fund a structural alternative. Further, a phased, long-term abandonment/retreat alternative will totally avoid impacts to the significant aquatic resources present in the study area, as well as impacts to commercial and recreational fishing activities and revenues. The final feasibility report and EIS should include the relocation option in a Table similar to Table 17 in the DFR.

**Corps Response:** See response to comment 4.06.38.

**4.06.45 USFWS Comment: Evaluation and Selection of the Artificial Berm and Dune System -** The DFR states (p. 42) that selection of the preferred alternative was based on "engineering and economic analyses." The documents do not mention that environmental considerations played a role in the selection. As often occurs, the preferred alternative is not so much selected as it is the only option remaining after the elimination of all other options.

The selection of the artificial berm and dune system was not based on a detailed discussion of its efficacy over the long term. The DEIS notes (p. 3-1) that small scale emergency measures such as sandbagging and beach scraping are "ineffective at battling the receding shoreline over the long term." However, the document presents no evidence that the millions of dollars to be spent over decades on the artificial berm and dune system would be any more effective. The DFR (p. 53) merely states that all designs for the artificial berm and dune system would "effectively control long-term shore erosion." This statement is misleading. Shoreline erosion would continue after the artificial berm and dune system is built. This erosion is the reason that approximately 4.16 million cubic yards of new sediment must be added to the area every three years. The DFR should state that the preferred alternative would create a sacrificial barrier (a mass of sand that is expected to be washed away and periodically replaced) in front of beachfront structures in order that shoreline adjustment can work on the artificial barrier rather than the existing shoreline. The process referred to as "beach erosion" will not be "controlled" by any Corps intervention, but can be expected to intensify over the decades of project life.

**Corps Response:** See response to 4.06.32. The Corps certainly recognizes that material will be eroded from the project and have to be periodically replaced.



However, in doing so, the project will prevent additional erosion of the "existing" beach and keep the ocean shoreline well seaward of its present location.

**4.06.46 USFWS Comment:** It is unclear how the project purpose played a role in the selection of berm width within the preferred alternative (DFR, pp 43-60). Berm widths of 50, 100, 150, and 200 feet were studied as alternatives, and the 50 feet was selected as the preferred alternative. In terms of storm damage reduction, "wider is better" is the generally accepted norm for berm width. The DFR indicates (p. D-36) that this width yielded the best economic situation for the project because the wider berms could not physically be maintained in the high-energy system of the project area. Thus it would appear that while wider berms are typically preferred for storm damage reduction projects, such a project in this area could not be economically maintained.

**Corps Response:** Naturally, the bigger the pile of sand, the more protection would be gained. However, projects are formulated on the basis of maximizing net benefits. There are less net benefits with the wider berm plans than the NED Plan. That is, the costs of the wider plans are increasing at a higher rate than the associated benefits as demonstrated in table H-5, Appendix H.

**4.06.47 USFWS Comment:** The Service is concerned that the offshore material used to construct the dune and berm would be different from existing beach material and thereby alter the habitat characteristics of the beach. The borrow materials proposed for this project are all finer than the native sediments in the project area. The Outer Banks of North Carolina have some of the highest wave energies on the East Coast, and their underlying geology contains a significant amount of coarse sands and gravels. Pea gravel is common on Kitty Hawk beaches, for example. Placing fill on these beaches that is finer than the native sediments will hasten erosion of the fill and resuspension of fines in the water column. Both an increase in sediment movement created by higher erosion rates and an increased turbidity in the water from fines washing off the artificial beaches will adversely affect fish and wildlife resources.

**Corps Response:** The foreshore portion of the native beaches do contain significant quantities of relatively coarse grained materials including some in the pea gravel range. However, the greater bulk of the native beach sands, which extend to water depth of 27 feet below NGVD, are made of medium to fine grained sands. When the composite grain size characteristics of the entire native beach is compared to the composite characteristics of the borrow material, the two distributions are closely matched. The compatibility analysis between the native and borrow area sands recognizes that there is some difference in the two and that additional borrow material will have to be placed along the shoreline in order to provide sufficient quantities of the coarser grained sediment. This additional material is identified by the overfill factors to be applied to each of the proposed borrow areas.

**4.06.48 USFWS Comment:** The sediments proposed for initial construction of the North Project Area are "less compatible material" with the native sediments, and thus 50% losses are expected from this area (Appendix D, p. D-4). The geotechnical data describing the N1 borrow area in Appendices E and I indicate the presence of significant quantities of mud and unsuitable materials for beach disposal. In fact, 20 of the 27 cores taken in the N1 borrow area have mud contents exceeding 10%, and only 7 are completely clean of mud. By averaging all of the cores together over the entire borrow area, the Corps generates an average mud content for N1 of 9%. With current technology, practical dredging procedures preclude a 100% mixing of all of the sediments in the borrow area before they are placed on the beach. Dredges fill to their capacity from a subset of the borrow area, then pump out those sediments to the beach. Thus the mud content within sections of the borrow area will not be mixed with clean sediments from other parts to average 9%. Localized pockets of very muddy sediments will end up on the beaches in the North Project Area. To minimize the adverse impacts to the environment, the Service recommends elimination of borrow site N1 as a source of material for the dune and berm for sediment compatibility reasons.

**Corps Response:** The actual number of cores used to define the characteristics of the material in Borrow Area N1 was 35. Data for each of these cores is provided in Tables E-3A and E-3B of Appendix E in the feasibility report. Table E-3A provides data for the 6 cores taken in 1995 while Table E-3B has data for the 29 cores taken in 1998. The cores, which varied in total length from 2 feet to slightly less than 20 feet, were used to determine the depth below the surface where suitable beach quality material was located. For example, core number 430 (labeled Boring Hole #430 in Table E-3A) had a total length of 504 centimeters (cm) or 16.5 feet while only the upper 77 cm (2.5 feet) was considered to be acceptable beach quality material. Therefore, removal of material from the vicinity of core 430 would be limited to a depth of cut of 2.5 feet below the existing bottom. Accordingly, only this upper layer of material was used to determine the size characteristics of the material that would be removed from the area represented by core 430. All of the 35 cores used to define the characteristics of the material in N1 were evaluated in a similar manner, as shown in the tables. Based on this method of analysis, which properly represents the characteristics of the borrow material that would be removed and placed on the beach, only 9 of the 35 cores had percent silt contents greater than 10 percent. The useable length of four of these holes were only 4 feet or shorter. The weighting process used to determine the average size characteristics for the entire area was then based on the useable length of each core and the assumption that each core represented the same surface area of the borrow area. The Corps recognizes that there may be pockets of unsuitable material within N1 that will have to be avoided altogether in order to prevent unacceptable materials from being pumped to the shoreline. Since construction of the north project will only require the removal of 83 percent of the available volume, avoiding these unacceptable areas will not be a problem. Prior to construction, much more detailed subsurface investigations will be carried out to further identify the good and bad areas within N1. These detailed investigations will involve the taking of bore holes in a 500-foot grid

pattern over the entire area. This hole spacing will provide sufficient definition of the material characteristics throughout N1 to allow us to develop a borrow area use plan that will avoid the unacceptable areas by limiting the depth of dredging in some areas, such as that represented by core number 430, or avoiding certain portions of N1 altogether.

**4.06.49 USFWS Comment:** The Service is also concerned that the selection of the preferred alternative represents a short-sighted approach to storm damage reduction by using the natural resources of the seafloor to artificially maintain a barrier to natural oceanic processes. At the end of the 50 year project life, 71-72% of the locally available borrow material will be used up. The sediment supply for this proposed project is not unlimited. Over 79 million cubic yards (mcy) of material will be introduced to the nearshore coastal system and removed from the offshore system. This is a wholesale alteration to two coastal ecosystems, and the environmental forcing mechanisms currently existing in both. These 79 mcy are not expected to stay on the beaches in the project area. The DFR does not adequately address where these sediments will go. The borrow areas will have a crater that not only alters wave conditions but also the seafloor benthic substrate. At the end of the project life, and as the sea level continues to rise, the need for the project will only increase. Increased development and predictions about increased storm frequency and inlet formations on the Outer Banks would only exacerbate the situation.

Two broad areas of supposed analysis appear to dominate in the selection of the preferred alternative: computer models used to predict shoreline conditions and economics. These areas are considered below.

**Corps Response:** The feasibility report and the DEIS adequately address the changes in sediment transport likely to occur as a result of the project. A detailed discussion of the expected changes in longshore transport is provided below in response to comment 4.06.51 with offshore losses of the beach fill material is covered in response to comment 4.06.67.

**4.06.50 USFWS Comment: Use of Models in Selecting Preferred Alternative -** The DFR uses several mathematical models to estimate the performance and maintenance needs of the beach fill material, the storm damages to structures in the project area, and economic benefits of the preferred alternative. The alternative evaluation process and selection of a preferred alternative are dominated by shoreline response models, which are presented with data from limited periods and supplemented with assumptions. Each of these models, and their applications to this project, make assumptions about the natural environment that do not allow the impacts to fish and wildlife resources to be adequately addressed in the DFR and DEIS.

**Corps Response:** Disagree. Sufficient information has been provided to allow the FWS to evaluate the impacts of the proposed project on fish and wildlife resources. We have provided information on the length of the project, the cross-sectional

configuration, the volume of material required for initial construction and periodic nourishment, the timing of the nourishment operations, the ocean bottom area to be impacted, changes in sediment transport, possible variations in sediment transport due to variable wave conditions, and the character of the native and borrow materials. While the FWS may question the models and methods employed by the Corps to develop the project, the project that is being recommended is well defined.

The models used to formulate the Dare County Beaches project are accepted engineering tools with known limitations with respect to simulations of natural process. These models provide a sound engineering basis for making comparative analysis between alternatives.

**4.06.50(a) USFWS Comment:** The DFR states (p. 53) that all designs for the artificial dune and berm would "effectively control long-term shore erosion." This statement should be qualified by an introductory phrase noting that computer modeling studies have been used to predict the efficacy of the artificial dune-berm system. Any significant deviation from the storm frequency and sand transport assumptions used in the Corps models can result in significant departures from model predictions, as has been the well-documented case for numerous other Corps beach nourishment projects in North Carolina and elsewhere.

**Corps Response:** The plan for the Dare County Beaches employed a life cycle model which simulated a wide range of possible storm occurrences and intensity. The possible variations in the cross-section provided by the project during various stages of its life cycle and the variable beach nourishment requirements resulting from various storm sequences are all included in the formulation of the plan and fully discussed in the feasibility report and the DEIS. With regard to existing beach nourishment projects, the nourishment requirements for the two oldest storm damage reduction projects in North Carolina (Wrightsville Beach and Carolina Beach) have been fairly constant over the last 15 to 20 years. This in spite of a rather varied storm climate. Nourishment requirements for the newest project located along Kure Beach, which will be carried out in 2001, agree with our predictions, again in spite of an unusual period of hurricane activity.

The DFR uses a mathematical model called GENESIS (Generalized Model for Simulating Shoreline Change) to predict the performance of the preferred alternative. The Wilmington District, or South Atlantic-Wilmington (SAW), had these analyses performed by the Engineering Research and Development Center (ERDC), and a summary of the results are provided in a report prepared by Thompson and Gravens (1999). There are several key assumptions and simplifications that GENESIS uses and that are used in other models by the Corps which have been severely criticized in the scientific literature (Thieler *et al* 2000, Young *et al* 1995).

**4.06.50(b) USFWS Comment:** First, the model makes several assumptions that oversimplify natural conditions. The model assumes, for example, that the shorelines and underwater bathymetry in the project area are straight with parallel contours. In

fact, the shoreline and bathymetric contours are much more complex and variable in Dare County. This assumption precludes the presence of offshore sandbars and underlying outcrops of peat, mud or rock. The Outer Banks have been documented to have sandbars and geologic outcrops (Riggs *et al* 1996, Kraft 1969). The Corps' profile data in Appendix E documents the presence of offshore sandbars throughout the project area, yet they are not included in the model simulation of the existing conditions used to justify the chosen alternative. No sand is lost by wind to dunes or by overwash to the island interior in the model. Instead, sand remains within the precise boundaries that the user has designated. Bottom currents, intrinsically involved in sand transport, have been documented to exist (Hayes 1967, Morton 1981, Snedden *et al* 1988, Gayes 1990, Wright *et al* 1991, Thieler *et al* 1995, Wright 1995), but the model assumes that they do not. GENESIS also assumes that the sea level is not rising. Yet sea level is rising globally at about 1 foot per century and may rise one to three feet over the next 100 years. Thus the Corps implicitly and incorrectly assumes that a rising sea level will have no impact on the preferred alternative over the lifespan of the project. Obviously several basic assumptions utilized in the model make the results suspect.

**Corps Response:** Disagree. The offshore hydrography was represented in the simulations through wave transformation analysis using STWAVE. The results of the STWAVE analysis are used as boundary conditions to drive sediment transport within the GENESIS model. GENESIS does assume parallel contours within the domain of the model boundaries. However, since the offshore boundary for GENESIS is the 10 meter depth contour, the assumption of parallel contours is not a major limitation of the model as depth contours within this region approach parallelism.

**4.06.50(c) USFWS Comment: Second,** none of the waves used in the model are actually measured in the field, but instead they are estimated, or hindcast, from old wind speed measurements. These waves are commonly referred to as WIS (Wave Information Study) data. The Corps took 20 years of these hindcasted waves (1976-1995), but used 1982-84 as "typical years" since the model output for those years matched the longshore transport rates targeted by the Wilmington District (Thompson and Gravens 1999, p. 22). So 1982-84 was chosen as average years for waves, and waves from these three years were used in model predictions. The problem with this critical assumption is that no major storms struck the Outer Banks during 1982-84. The main purpose of the project is to reduce storm damages, yet no model simulations were calculated to see how the artificial beaches would perform in a projected storm wave scenario.

**Corps Response:** The use of WIS wave data is an accepted coastal engineering practice. In the case of Dare County, the WIS data compared favorably with wave data collected by the Field Research Facility and wave data from a NOAA offshore data buoy. The 1982-84 wave data was used to represent average sediment transport conditions. However, as FWS recognizes in later comments, the analysis also included years in which sediment transport potentials were well above the norm

as well as years in which the predominant direction of sediment transport switch from its normal north to south predominance to a south to north predominance.

**4.06.50(d) USFWS Comment:** A **third** critical flaw in the GENESIS model is that it assumes all sediment moves along the shore, or parallel to the beach. No sediment moves across the shore, or perpendicular to the beach. However, many scientists have documented that cross-shore currents exist and can move a significant amount of sediment (Swift 1976, Snedden *et al* 1988, Wright *et al* 1994). In fact, the Corps has created another model that assumes all sediment moves across the shore and ignores all longshore transport, which acknowledges the importance of this coastal process. However, that model, called SBEACH, was not used in the current planning effort.

**Corps Response:** The purpose of the GENESIS model is to evaluate changes in the longshore transport regime and associated shoreline response associated with coastal protection structures including beach fills. Offshore sand transport is normally associated with storm waves that move sediment from the nearshore and deposit it in the offshore to form shore parallel bars and shoals. While some onshore recovery takes place following these storms, there is a certain volume of displaced material that stays offshore. The effects of this offshore storage of material is reflected in the shoreline change history of the area. Since all of the GENESIS simulations included the background erosion occurring in the study area, these offshore losses are implicitly included in the overall shoreline response represented by the GENESIS results.

**4.06.50(e) USFWS Comment:** Perhaps the greatest criticism of the GENESIS model, however, is what are known as the "K" factors. There are two variables in the model that are simply fudge factors. These two variables are what engineers use to calibrate the model, or make the predictions fit the data. The K values can be adjusted so that everything in the model matches up correctly, but they have no basis in reality. K1 and K2 are arbitrarily set at 0.8 and 0.2 in Thompson and Gravens (1999, p. 20), but no justification or sensitivity analyses for the selection of these values is provided.

**Corps Response:** The method used to adjust the K factors in this simulation is an accepted modeling practice. All numerical models have coefficients or other variables that are used to adjust the model results to agree with observed changes or behavior of the system being modeled. In hydraulic models, the coefficient is normally adjusted to make the model replicate observed flows. In this case, the K factors were adjusted and sources and sinks of material added to the simulation in order to get the model to reproduce observed changes in the shoreline. Once these adjustments were for the base conditions, all with project simulations were run using these same coefficients and same sources and sinks. Thus, the model was able to predict relative changes in shoreline response and sediment transport associated with the placement of material along the project area.

**4.06.50(f) USFWS Comment:** Besides these severe criticisms of the Genesis model, the Service is very concerned about the assumptions and calibration the Corps used in its application of the model for this preferred alternative. The boundaries of the area of shoreline and ocean used in the model simulations exclude Oregon Inlet (see DEIS, Figure 4-1), even though inlet systems are generally known to influence up to a mile or more of the adjacent shorelines. The model grid used for this project extends 6.1 miles north of the North Project Area but only 4.0 miles south of the South Project Area, stopping 0.8 miles from the inlet so as to exclude its associated shoals (Thompson and Gravens 1999, p. 16). This elimination of Oregon Inlet from consideration by the model biases the model domain to the north and prevents the simulations from accurately representing the natural coastal conditions in the project area. The inlet, its shoals and tidal currents are artificially set to not influence the performance of the project. Thus any longshore sediment transport figures that the model generates do not incorporate Oregon Inlet as a potential sand source or sink, and such results are not representative of existing conditions.

**Corps Response:** GENESIS is a littoral sediment transport model and does not include simulation of sediment transport caused by tidal currents. Accordingly, the south boundary of the GENESIS model was established north of Oregon Inlet outside the influence of tidal currents flowing in and out of the inlet. Again, this is accepted engineering practice.

**4.06.50(g) USFWS Comment:** Furthermore, the fill lengths modeled by ERDC were much shorter than proposed by DFR as the preferred alternative. The north project area appears to have been 8,600 feet in all simulations, with variable transition lengths. The south project area was modeled at 37,600 feet long (Thompson and Gravens 1999, p. 38). With 3,000 foot transitions for both areas as proposed in the preferred alternative, this yields model simulations of 2.8 and 8.3 mile fill areas respectively. Yet the preferred alternative is to fill 4.1 miles and 10.7 miles for the north and south project areas, respectively. The Service is concerned that if none of the model simulations accurately depict the proposed project, then the results of these simulations are not applicable to the alternative proposed and to the assessment of project impacts.

**Corps Response:** The primary purposes of the GENESIS simulations were to evaluate end losses from the proposed fills and determine the impact of removing sediment from the offshore borrow areas on the response of the shorelines in the project area and sediment transport out of the project area. The simulations were carried out prior to finalization of the overall scope of the project. Note that the final scope of the project depended, to a certain extent, on the GENESIS results. The results of the GENESIS analysis for the shorter simulated area were prorated for the final scope of the project and included in the final plan formulation runs. We recognize that the exact project area was not simulated in the report, however, simulation of the final project area would not have changed the plan formulation.

Once the project proceeds to the detailed design stage, additional GENESIS simulations will be made to refine the project nourishment requirements.

**4.06.50(h) USFWS Comment:** Additionally, the draft report summarizing the GENESIS analyses (Thompson and Gravens 1999) states that the Wilmington District provided the ERDC with longshore transport rate numbers that the GENESIS model had to match:

"Detailed GENESIS model calibration to historical shoreline positions, the typical procedure, was not performed in this study. Alternatively, **SAW provided target sediment budget information, which was to be reproduced in model simulations.** SAW defined the net and gross longshore sand transport rates, and they provided spatially dense information on longterm shoreline change rates, for the project domain. Both pieces of sediment budget information were based on previous analyses they had done. Reproduction of the target transport and shoreline change rates was accomplished in the modeling via specification of background erosion/accretion rates. A reasonably good reproduction was achieved, and accepted as calibration of the GENESIS model." (Thompson and Gravens 1999, p. 21) [emphasis added]

**Corps Response:** The GENESIS calibration procedure targeted both shoreline changes and sediment transport rates. The sediment transport rates were rates predicted by the WIS wave data. While these rate were used in the evaluation of the sand management plan for the Oregon Inlet stabilization project, the rates agree with independent sediment transport rates reported by Inman and Dolan (1989). The calibration process also required the addition of certain sources and sinks along the study area in order to reproduce the historic shoreline changes for the area. These same sources and sinks were included in all "with project" simulations.

(Inman, Douglas L. and Robert Dolan, "The Outer Banks of North Carolina: Budget of Sediment and Inlet Dynamics Along a Migrating Barrier System," Journal of Coastal Research, Spring 1989.)

**4.06.50(i) USFWS Comment:** It appears the Wilmington District told ERDC what was wanted in terms of longshore transport numbers and GENESIS was manipulated to come up with transport rates that agreed with their predetermined "answer." Normally, GENESIS is used to determine the longshore transport rates, which then determines the shoreline position. Since the Wilmington District already had longshore transport numbers in hand, it is unclear why GENESIS was needed. If these rates were measured in the field, and widely accepted as accurately representing existing coastal conditions that alone would allow the model to be calibrated to replicate natural processes in the project area.

**Corps Response:** See previous response.



**4.06.50(j) USFWS Comment:** The longshore transport numbers provided to ERDC (Thompson and Gravens 1999, p. 21) are not known to the Service as having been measured in the field. The numbers seem to match those generated in other GENESIS simulations for the Oregon Inlet jetties project instead, which were based on yet a third set of GENESIS simulations for northern Dare County. The DEIS states (p. 6-6) that since 1983 an average of 490,000 cubic yards of material has been dredged annually from the Oregon Inlet area, but the quantity of material has varied greatly from zero to more than 1,100,000 cubic yards with a standard deviation of 320,000 cubic yards per year. Maintenance dredging for the ocean bar at Oregon Inlet, the most hazardous area for commercial fishermen, averages 300,000 cubic yards per year (cy/yr) (Howard Varnum, U. S. Army Corps of Engineers, Wilmington District, August 30, 2000), so it is unlikely the historical dredging needs generated the preconceived 0.8 to 1.0 mcy/yr longshore transport rates.

**Corps Response:** The average dredging requirements for Oregon Inlet reported in the DEIS were based on actual pay volumes for the various contracts awarded since 1983 for the ocean bar channel. The dredging estimate provided by Mr. Varnum was based on his recollection of recent dredging operations in Oregon Inlet and was not based on actual reported pay volumes.

**4.06.50(k) USFWS Comment:** Not surprisingly, Thompson and Gravens (1999) found that their application of GENESIS to the (shorter) nourishment project yielded longshore transport numbers that were "significantly less than the target rates" (p. 21). Comparison with measured waves from the Duck Field Research Facility (FRF) instead of hindcast WIS waves generated similar numbers that were much less than the numbers provided by the Wilmington District. Thompson and Gravens (1999) provide a few potential reasons for this discrepancy, one of which was that the Wilmington District's numbers were "too high" (p. 22).

In order for the model to be calibrated to the predetermined rates, the ERDC modified the waves input into the model by rotating them all counterclockwise by 5 degrees (Thompson and Gravens 1999, p. 22). By manipulating the data the ERDC was able to generate output numbers that matched those requested by the Wilmington District. It should be noted that to conduct other model simulations to forecast the performance of the fill material during a period of reversed net longshore transport (i.e., from south to north), the ERDC had to remove this 5 degree wave rotation to allow natural, historical conditions to be simulated (Thompson and Gravens 1999, p. 55).

The model was considered calibrated when ERDC tuned the model until it yielded the longshore transport numbers that were requested by the Wilmington District. This is very different from the standard tuning method used in GENESIS, wherein one gets a set of historical shorelines and tries to tune the longshore transport rates until the simulated shoreline agrees with the real historical shoreline (i.e., the longshore transport rate is the unknown for which you are solving; it appears the

Corps did the opposite without mention of shorelines agreement). By rotating the wave angle, the Corps increased the breaker angle and thus the longshore transport rate. If our interpretation is correct, this is an example of how a model can be manipulated to achieve the desired results.

Another calibration procedure used to facilitate the model simulations was to smooth out the documented shoreline erosion rates. The Corps let the model define the initial condition of the shoreline because the real data did not work right and created "undesirable behavior" (Thompson and Gravens 1999, p. 24). The documented shoreline did not respond to the hindcast waves from 1982-84 input into GENESIS, so the model was run for 5 years to "a more-or-less smoothed version of the initial shoreline" that removed +/- 3 ft/yr off the measured erosion rates (Thompson and Gravens 1999, p. 24). Basically the Corps ignored the initial (measured) shoreline and substituted a shoreline that: (1) is not realistic, and, (2) could literally have been drawn by hand with a mathematically equivalent result. While this generated the desired results, the Corps appears to have arbitrarily set natural conditions to fit an artificial model in an effort to achieve preconceived results based on yet another model. Models should be calibrated with real world information, not with other model-derived numbers. Oreskes et al. (1994), Baker (1994), and Konikow and Bredehoeft (1992) all argue that calibration-verification procedures cannot be used within earth surface systems to begin with because earth systems are open systems, but numerical models treat them as closed systems.

Finally, every model simulation run with GENESIS assumes that the sediments are significantly coarser than what is documented to occur in both the borrow and fill areas. The model simulation assumed that all the sand in the project area, both native and fill material, was 0.45 millimeters (mm) in grain size (Thompson and Gravens 1999, p. 20). Appendix E of the DFR reports that the native grain size averages 0.31 mm in the North Project Area and 0.26 mm in the South Project Area (p. E-3), however, with a range of roughly 0.12 to 4.0 mm (p. E-24). The borrow fill averages 0.22 mm for the NI borrow site and 0.34 mm for S I (p. E-5). Thus the model assumed that the sediments in the project area were significantly coarser than the averages measured anywhere in the borrow or fill areas. Coarser sediments last longer on a nourished beach than finer fill sediments, so this unsubstantiated assumption regarding grain size likely led to a significant overestimation of fill performance.

**Corps Response:** GENESIS uses the average grain size to establish the overall shape of the beach profile. Only a single profile shape is represented throughout the model domain. The shape of the profile is used to calculate breaking depths and surfzone widths over the simulation period. These parameters become important when the effect of structures (i.e. groins, breakwaters) are being evaluated on the shoreline response. In this case, no hard structures are being considered; therefore the use of the same material in the model is of minor consequence. Further, the difference between the native and borrow material is appropriately accounted for in

the project by applying overfill factors for S1 & N1 as discussed in Appendix E, Sand Compatibility Analysis.

**4.06.50(I) USFWS Comment:** In short, the predictive capability that this preferred alternative's design and maintenance plans are based upon is extremely limited and highly suspect. The limitations in predicting changes in the artificial berm and dune affect all aspects of the project from the frequency that additional sand placements would be required to areas that would receive sand from the project area. These uncertainties reduce the possibility that the magnitude and frequency of negative impacts to fish and wildlife resources, as well as the Cape Hatteras National Seashore, are likely to be insignificant.

**Corps Response:** Disagree. The overall plan formulation process included a range of variables acting in a random fashion that resulted in a wide range of possible project outputs and operational requirements. The entire analysis was conducted in an acceptable manner and followed procedures dictated by Corps of Engineers planning guidance.

**4.06.51 USFWS Comment:** The Corps believes that the preferred alternative is not likely to adversely affect navigation through Oregon Inlet. The DFR reports (p. 91) that ". . . model investigations reveal that a minor increase in net southerly transport would result from fully excavating all offshore borrow areas during the 50 year project life. Under this condition, an approximately 13 percent increase in maintenance dredging could result at Oregon Inlet or about 65,000 cubic yards per year . . . the possible increase in maintenance dredging is well within the historical variation under the worse case condition."

Thompson and Gravens (1999) do not discuss the potential for increased sediment transport to Oregon Inlet, and **purposefully** exclude the inlet system from the model simulations. Therefore, it is unknown how the figure of 65,000 cy/yr of additional sand was calculated. The model predicts that the beach fill will last less than three years, and that from Whalebone Junction south, the longshore transport rate will exceed 1.21 million cubic yards (mcy) per year as the fill spreads to the south (Thompson and Gravens 1999, p. 25). This is the material that would be carried annually by the longshore transport current along the shoreline only 0.8 miles north of Oregon Inlet. However, the Oregon Inlet jetty project (USACOE 1999a, General Design Memorandum, p. 3-24) estimates background longshore transport to be an average net movement of 862,000 cy/yr to the south. Therefore, it would appear that construction of the proposed berm and dune would increase the average longshore transport at Oregon Inlet by approximately 348,000 (1,210,000 - 862,000) cy/yr unless 283,000 (348,000 - 65,000) cy/yr stops immediately north of the inlet. Project plans offer no explanation of why such a large amount of sand would be carried south of the placement area, but stop immediately north of Oregon Inlet with only 65,000 cy/yr above the pre-project base transport rate continuing on southward to the inlet.

**Corps Response:** The potential for increased sediment transport out of the project area was assessed by comparing the transport rates at the northern and southern model boundaries for both existing and dredged borrow area bathymetry. The results revealed that changes in transport rates due to the various nourishment projects are confined within the model domain; whereas, changes in sediment transport due to dredging the borrow area were evident at the southern boundary of the model. The results showed an increase in the potential net southerly transport of about 130,000 cy/yr when comparing the existing to the fully dredged borrow area condition. Since this potential increase in sediment transport is based on the removal of all the suitable material from Borrow Area S1, this increase would not occur until near the end of the 50-year life of the Dare County Beaches project. Also, the Dare County Beaches project would only use 67 percent of the suitable material in S1. Accordingly, this potential increase in littoral transport toward Oregon Inlet is considered to be the "worst case." Assuming that this maximum rate of increase in sediment transport toward Oregon Inlet occurs linearly over the 50-year project period, southward sediment transport would increase by 26,000 cubic yards per year every 10 years. Sediment budget history of Oregon Inlet shows that the ratio of the quantity dredged from the inlet to the net sediment transport volume is about 0.5. Applying this ratio to the potential increase in sediment transport results in the possible increase of 65,000 cy/yr in maintenance dredging of the inlet. Again, this potential shoaling increase would not occur until the end of the 50-year project life of the Dare County Beaches project. Hence, potential increases in shoaling over the project life would be 13,000 cubic yards/year in project year 10, 26,000 cubic yards/year in year 20, 39,000 cubic yards/year in year 30, 52,000 cubic yards/year in year 40, and 65,000 cubic yard/year in year 50.

**4.06.52 USFWS Comment:** The DFR and DEIS fail to adequately consider the potential impact of such a large inflow of sediment and its significance in the presence of the terminal groin on Pea Island that prevents the inlet from migrating in response to an increased sediment budget from the north. The inflow of large amounts of sand would alter tidal exchange. If the inlet narrowed as the southern end of Bodie Island expanded southward, tidal flows could further undercut supports for the Bonner Bridge. In the event of a strong, hurricane-generated ebb storm surge, the terminal groin could be flanked and cut off from Pea Island.

**Corps Response:** The projected increased shoaling rate of 65,000 cubic yards per year would only be applicable once essentially all of the borrow material is removed from potential borrow area S1. Obviously, this would not occur until the end of the 50-year project life of the Dare County Beaches project. Natural variation in sediment transport from year to year and variations in the amount of dredging performed in the ocean bar channel of Oregon Inlet are much greater than 65,000 cubic yards per year. Accordingly, assigning specific inlet responses to such a small increase in channel shoaling that may or may not occur 50 years after the initial construction of the beach project is too speculative to warrant consideration.

**4.06.52(a) USFWS Comment:** Additional model simulations summarized in Thompson and Gravens (1999) appear to have been conducted in an attempt to see how sensitive the model outputs were to alterations in the waves and longshore transport directions. Results of the experiments to predict the fill performance during years of high longshore transport rates indicated that this "significantly degrades [the] project performance and increases volumetric requirements of the design alternatives. ... renourishment requirements increase by about 20 to 25 percent [for Kill Devil Hills] and in the Nags Head project ... by about 50 percent" (Thompson and Gravens 1999, p. 52). Further simulations tweaking the wave climate to one the authors deemed more realistic increased the renourishment needs in Nags Head by 100 percent (Thompson and Gravens 1999, p. 55).

Similar results were found if the direction of net longshore transport was reversed (i.e. to the north). Transport reversals simulated by GENESIS indicated a 2 to 4% increase in the volume of material needed for renourishment at Kill Devil Hill and 30 to 35% at Nags Head (Thompson and Gravens 1999, p. 61). The latter increases to 70% if more probable wave scenarios (Thompson and Gravens 1999, p. 61) are used. These supplemental simulations imply that any year that differs from 1982-84 conditions could significantly degrade the project, leading to increased costs, decreased storm damage benefits, and a shorter renourishment interval that would not allow fish and wildlife resources to fully recover and significantly increase project costs.

**Corps Response:** The simulation of extreme conditions was carried out to assess the possible range of project performance under less than favorable or average conditions.

**4.06.52(b) USFWS Comment:** The Corps does not adequately describe how waves from 1980, 1981 and 1989 were selected for the first set of experiments and 1980, 1983 and 1985 for the latter. How can 1980 represent both a higher longshore transport rate and a reversal in direction? Data from 1983 are also used as one of the "typical" years for waves in the performance simulations. The Corps does not provide information on whether this means the natural conditions in 1983 were a reversal in net longshore transport direction, and that the 5 degree wave direction calibration altered this fundamental characteristic of the input data such that the net transport was to the south. If the latter is the case, then all simulations based upon the tweaked 1983 data are meaningless and cannot be used to evaluate the project performance or its impacts on fish and wildlife resources. The impacts to the existing coastal processes by dredging borrow pits at the proposed sites for 50 years were also studied by Thompson and Gravens (1999). The GENESIS simulations suggest that the removal of the offshore shoals in the borrow areas will alter the wave dynamics of the project area. The ERDC found that dredging of all the borrow areas in the worst-case scenario positively influenced the northern project area in terms of altered wave conditions, but degraded the southern project area. Figure 30 in Thompson and Gravens (1999, p. 34) shows that the wave heights striking the beach will be modified from +7 to -12 percent. The waves will also strike the coast at

different angles, ranging from +5.5 to -3.0 degrees different than existing conditions. The ERDC thus recommended avoiding dredging of S2 and S3 to minimize the negative impacts to the Nags Head fill area (Thompson and Gravens 1999, p. 62). So if the waves change, the direction of longshore transport changes, or the magnitude of longshore transport changes, the performance of the fill is estimated to be significantly impaired. Tweaking to more realistic scenarios as defined by ERDC generates similar predictions.

**Corps Response:** The 1980 wave data represented both a high wave energy year as well as a year in which sediment transport was predominantly to the north. How this can happen is simply a case in which storm activity produced high wave incidences from the southern quadrants rather than the north. With regard to the other matters in this comment, the Corps believes that the explanations given in response to previous comments and the information provided in the feasibility report and FEIS adequately explains the rationale and procedures used in the formulation of the Dare County Beaches project.

**4.06.52(c) USFWS Comment:** These alterations to the hydrodynamic conditions of the project area will not only influence the fill's durability, but also the wave energy and patterns that partially control the distribution of sandy beach in fauna (Donoghue 1999, Bowman and Dolan 1985). The ability to maintain burrows and optimize filter feeding appears to be directly related to both grain size and hydrologic parameters, both of which would be altered by this artificial beach fill project. If the N1 borrow site is eliminated to minimize adverse affects on the environment, the wave dynamics predicted by Thompson and Gravens (1999) will be altered. The Corps should provide further wave transformation analyses for the project area if the preferred alternative is to restrict dredging to S1 only.

**Corps Response:** The Corps does not intend to eliminate N1 as a source of beach nourishment for the initial construction of the north project. Wave transformation studies and the associated sediment transport analysis adequately describe the potential changes in shoreline response and sediment transport that are likely to occur as a result of using both S1 and N1 to construct and nourish the project.

**4.06.52(d) USFWS Comment:** Using a continuous cycle of wave conditions from 1982, 1983 and 1984 to estimate the performance of the project for 50 years is not reasonable. Wave conditions, background erosion/accretion rates and longshore transport magnitudes and directions all fluctuate on an annual, monthly and even daily basis. Assuming that they will remain constant within the hindcast and tweaked 1982-84 conditions further oversimplifies the dynamic and variable nature of coastal systems.

**Corps Response:** Disagree. The purpose of the continuous analysis was to simulate shoreline response up coast and down coast of the project and to determine if the project would simply form its own transition through the longshore

distribution of sediment from the primary project area. Average wave conditions were the appropriate perturbation mechanism for this analysis.

**4.06.52(e) USFWS Comment:** Overall, the model simulations for estimating the physical impacts of the preferred alternative do not replicate natural conditions in many critical ways. The existing shoreline was essentially eliminated when it generated "undesirable behavior." The waves were rotated 5 degrees and the erosion rates were smoothed out when the longshore transport numbers did not match the predetermined answer. The fill dimensions were shorter than the NED plan. The grain size used in the model did not match anything measured on the beach or in the borrow areas. The project was not tested for its performance during a storm. All of these factors lead to the Service to conclude that the GENESIS model simulations critical to alternative selection provide no useful information on which to evaluate the physical and biological impacts of the proposed project.

The DFR states (p. D-39) that the modeling exercises indicated that a 1000 foot transition area performed just as well as a 3000 foot taper, but the latter generated less maintenance needs over time. The Corps therefore has no engineering justification for extending the project along 8000 feet of shoreline between the two project areas, which would increase the impacts to fish and wildlife resources just to save maintenance costs. The DFR should compare how much money would be saved by adversely affecting the environment and causing environmental costs against the assumed increases in maintenance costs without engineering justification.

**Corps Response:** Noted Again, the modeling techniques used to make GENESIS replicate observed changes along the Dare County shoreline are standard engineering and modeling practice. Once the model is adjusted to produce observed changes in the prototype, these same adjustments are applied to model runs for the with project conditions in order to obtain a comparison of the relative differences in response for the two conditions. There has never been a claim that the model results religiously mimic the natural system.

**4.06.52(f) USFWS Comment: Use of Economics in Selecting Preferred Alternative -** The Corps utilized two models to estimate the storm damages with and without the project and thus the economic benefits. A model called GRANDUC calculated the storm damages from a variety of storms occurring over the 50-year project life. The second model, STORM9, was a new one developed by the Wilmington District for this project.

STORM9 was created to predict the erosion distances and net volume losses to the beach system from a frequency distribution curve of storms (p. D-40). The DFR fails to provide any more information on this customized program, including whether it has been peer reviewed, published or the source code provided for review to independent parties. No details are provided as to how this model calculates the

erosion and volume losses resulting from different types of storms. As a result the Service, or any other reviewer, cannot evaluate the assumptions, relationships and accuracy of the model to replicate natural coastal processes. This customized "model" that provides answers on which the economic justification for the project is based should be fully disclosed for public comment and analysis. The Service has no means by which to evaluate the impacts to fish and wildlife resources resulting from the use of this model.

The STORM9 output is used as input into GRANDUC. GRANDUC attempts to comprehensively calculate the structural and content damages from the STORM9 scenarios to each building within a certain distance of the shoreline. However, the DFR does not adequately explain how this distance from the shoreline was delineated. This distance appears to range from 738 to 1400 feet for the north and south project areas, respectively (p. F-21). The Corps should provide maps of the entire modeling area with a detailed explanation to justify the selection of its apparent varying distances inland. If the distance inland over which damages would be reduced is too far, structures in the back that do not receive damages may inflate the benefits of the project if they are included.

**Corps Response:** Both the GRANDUC and STORM9 models were subjected to an intensive internal review by the Corps Institute of Water Resources (IWR). One of the leading experts in the field of risk and uncertainty participated in this review. Following the review, the models were modified in accordance with the recommendations provided by the IWR. In addition to the technical review of the models, the model outputs were evaluated by Corps Headquarters and South Atlantic Division personnel. The two models were judged to provide reasonable and consistent comparisons of the damages to be expected in the area and the damage reduction potential associated with various plan alternatives. The overall process used to develop the recommended plan was found to be in accordance with the Federal standards published in "Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies, U.S. Water Resources Council, March 10, 1983.

The feasibility report and FEIS provide clear and sufficient information on the scope of the project. This information should be sufficient to allow the Service to evaluate the impacts of this project to fish and wildlife resources.

**4.06.52(g) USFWS Comment:** The GRANDUC model as described in the DFR does not provide enough detail for the Service to adequately evaluate its assumptions, algorithms and uncertainties. This hinders a corresponding evaluation of the fish and wildlife impacts of the project.

**Corps Response:** Disagree. See previous response and response to FWS comments 4.06.50 and 4.06.52(f).



**4.06.52(h) USFWS Comment:** One parameter in GRANDUC, for instance, is a "storm recovery factor" (p. D-46). The Corps should provide a full discussion of the value of this factor, whether it varies across the project areas or is set to a constant, and its scientific and/or engineering basis and calculation. Some portions of coastal ecosystems are storm-driven, and the "storm recovery factor" may or may not relate to the recovery of biological and physical parameters.

**Corps Response:** See response to NMFS comment 4.02.11.

**4.06.52(i) USFWS Comment:** Ten types of erosion were used to categorize the project area for GRANDUC and STORM9 simulations, but the DFR does not offer any information on how these types were defined, what they were based upon, and to which reaches they were applied. GRANDUC assumes that the shoreline retreats uniformly and the beach profiles never change (p. F-1), so it is unclear how different types of erosion are resolved with these assumptions. Similarly, the variables listed in the net storm damage equation on page F-7 are not defined.

Long-term erosion is included in the GRANDUC model as well as storms. Once structures were determined to be undermined by long-term erosion, they were designated "inactive" in the model (p.F-8). The Corps should describe if these structures are then assumed to be removed from the system, and if so if there is an associated cost for their demolition and removal. If they are not removed, more information is needed on whether the obstructions the structures generate are incorporated into the model. It is unclear whether there is a threshold for the percentage of the structure that has to be undermined before it is considered lost in this manner. The Corps should explain if the 50% recession value discussed on page H-38 is such a threshold.

**Corps Response:** The erosion rates used in the plan formulation and hence GRANDUC are based on the long-term shoreline change data used by the State of North Carolina Division of Coastal Management. Once the shoreline reaches the front of a structure, it is assumed to be lost and is removed from the structural data base. Once removed from the database, no additional damages are computed for that structure for the remainder of that particular life cycle simulation.

**4.06.52(j) USFWS Comment:** The annual erosion rate is defined as incorporating an increase of 0.3 ft/yr due to rising sea level (p. F-13). The DFR should discuss what this value is based upon, what sea level rising rate was used, whether it is assumed there are no other sources of annual erosion since storms are separate in the model, and how the long-term erosion rate was used by the model, if at all. Also it seems incongruous that the economic models used as critical factors a rising sea level and the engineering models did not. This apparent disparity in methods should be explained.

**Corps Response:** The 0.3 feet/year component is assumed to be constant throughout the 50-year period of analysis. The ultimate amount of shoreline

recession at the end of the 50-year life cycle is set equal to the amount of erosion that would occur based on the long-term erosion rate applicable to that segment of the study area. Due to the variable occurrence and intensity of storms that may affect the area during any one life cycle simulation, the amount of shoreline recession that could occur from one year to the next during the simulation will vary. If no storms occur in a one-year interval in the analysis, the shoreline will be moved back a minimum of 0.3 feet. If a storm hits in the following year, the shoreline will be moved back by an amount equal to the storm recession less some storm recovery. For example, if a particular segment has a long-term erosion rate of 3 feet per year, at the end of the 50-year period, the net shoreline change will be approximately 150 feet. During the 50-year analysis period, however, there could be time intervals in which shoreline recession rates exceeded this long-term rate. Again, this will depend on the number and intensity of storms in a particular life-cycle run. The end result of this is that a particular structure may be taken out at different times during each life-cycle simulation.

**4.06.52(k) USFWS Comment:** The "erosion distance" resulting from various storms is another unknown parameter used in GRANDUC. The DFR states that this parameter is "calculated from [an] empirical method developed" by the Wilmington District (p. D-40). The Corps should revise the DFR to include a description of this empirical method and whether the erosion distance represents where there would be flooding, wave action, structural damages or shoreline recession, and whether it is calculated after each individual storm event in the 50 year simulation or after 50 years of storms. An explanation of how the erosion damage curves were calculated, and how the percent undermining of a structure is related to the percent damage in GRANDUC, should also be incorporated into the DFR.

**Corps Response:** The empirical method started by taking erosion volume frequency data from the literature. A multi-step procedure was then applied to get erosion distances. First, a curve fitted to the volume data was linearly transformed so that a hundred-year storm fell into a range of 100 to 200 feet. Second, the erosion from the high frequency storms was adjusted so that after storm recovery the net erosion was less than the long-term erosion rate. Third, the curve was adjusted so that as the berm was inundated the erosion increased to reflect the waves attacking the dune. Finally the point at which the transition from the high frequency erosion rates to the low frequency erosion rates occurred was based on the height of the dune. The erosion distance is a set of values for a certain frequency storm and is a measure of the distance the shoreline moves from a known reference line in the segment. Note that the position of all buildings and other features in the segment are also known relative to this reference line.

**4.06.52(l) USFWS Comment:** Furthermore, the uncertainty analysis performed on the GRANDUC simulations utilized a +/- 2 foot error on the erosion distance parameter (p. D-5 1). The Corps should provide data to support this narrow window of error based on historical erosion distances as they have been defined. The DFR states that more uncertainty parameters "can and will be added" in time as

GRANDUC is "more fully developed" (p. D-5 1). The Service recommends that the Corps make an estimate of the limitations of the GRANDUC model until such improvements can be made, and outline which areas of the model have been targeted as needing development and why.

**Corps Response:** The GRANDUC will eventually be modified to include other areas of uncertainty. However, including more uncertainty in the model would not change the plan that was ultimately selected.

**4.06.52(m) USFWS Comment:** Table F-1 on page F-13 lists the storm surge and setup elevations applied in these GRANDUC simulations. The Corps should describe in more detail whether the 500 year event storm surge of 11.70 feet listed in the table is equivalent to a category 3 hurricane, rendering category 4 and 5 hurricanes as greater than 500 year events. Historical storm surge elevations for various storms in the project area should be compared to the values in Table F-1. Insufficient information is available in the DFR to determine the with project conditions input into GRANDUC. If the model simply widened the beach to the preferred alternative design dimensions, and held those dimensions constant before each storm event, then the pre-existing conditions were probably not accurately portrayed. The initial construction of the project, for example, will create a beach much wider than the design to allow for equilibration of the fill material. A storm that struck at that point in time would find a beach wider than the design. After two years of erosional losses, which are higher than background rates for nourished beaches, the beach will be narrower than the design as it awaits its renourishment in the third year. A storm that struck the project area at that time would find a beach narrower than the design dimensions. How this variability in project condition is accounted for in GRANDUC and STORM9, if at all, is unknown and should be disclosed by the Corps. Similarly, the generation of the volumes of sand eroded by the storms should be described (i.e., whether they were based on GENESIS output, another model like SBEACH or STORM9, empirical evidence, or professional judgement).

**Corps Response:** The GRANDUC model allows the width of the plan cross-section to vary during the life cycle simulation in response to the number and frequency of storms. Accordingly, there may be times in the analysis in which something less than the full project cross-section is available. The reduced cross-section at the time of a particular storm event is reflected in the storm damages determined for that particular event. The amount of material eroded from the project profile by the storm is added to the subsequent nourishment requirement.

**4.06.52(n) USFWS Comment:** The DFR contains inadequate information on whether sandbags were considered as armoring in front of structures (Appendix F); how the annual volume loss (non-storm) was calculated for each reach (Appendix F); whether SBEACH was used to model the storm performance of the project; what wave attenuation parameters were used in GRANDUC (p. F-4); whether wave attack angle of 1 was applied uniformly to the project area for all life cycles and what angle

is equal to 1 (i.e., parallel or perpendicular to the beach) (Fig. F-4a); and how the silt factor is calculated for incorporation into overfill ratios (Appendix D).

The GRANDUC model uses all of these aforementioned parameters and others to calculate the storm damages to the given set of structures in the project area from a random storm history over the 50 year project life. In the sample scenario provided in Appendix F, 7000 life cycles (or storm histories) were used to generate a frequency distribution of the expected storm damages. The Corps should explain why only 500 life cycles were used in this project analysis, and whether the model is sensitive to the number of life cycles included in terms of the accuracy of the resulting frequency and probability curves. More information is also needed on how the life cycle storm histories were developed, especially regarding the Empirical Simulation Technique, what historical storm database was used, and the "multidimensional interpolation procedure" (p. F-3).

The probability curves are then compared for with and without project conditions, and the difference between the two is considered the reduction in storm damages, or economic benefits, for the project. Figure D-28, for example, shows the probability of total net benefits, or storm damage reduction, for the North Project Area with the preferred alternative. Various statistics are listed for the probability distribution, including a mode of -\$7.5 million and a range from -\$27.8 million to +\$89.6 million. While the average is +\$11.8 million for this project, the mode represents the most common benefits provided by the preferred alternative. The Corps should provide a detailed explanation of whether this negative number indicates that the North Project Area is in fact not likely to have positive benefits, but will instead be more likely to cost more than it protects. The graph implies that there is a 32% probability that the North Project Area will have negative benefits. The mode for the net benefits of the South Project Area, on the other hand, is +\$42.5 million and the probability for negative benefits is less than 2% (Fig. D-29, p. D-53).

**Corps Response:** The plan formulation procedure and the models used for the Dare County Beaches project have been reviewed and determined to meet all planning criteria. The recommended project is adequately described to allow an assessment of its potential impacts on fish and wildlife.

**4.06.53 USFWS Comment:** The GRANDUC simulations assume a constant interest rate of 6 5/8% over the 50-year life span of the project. Higher interest rates generally account for more risk and uncertainty, but the Corps did not raise the interest rate here to reflect the inherent risk and uncertainty associated with maintaining an artificial beach for 50 years along the highest energy coast in North Carolina.

The Corps used a land valuation of \$270,000 per acre in the GRANDUC modeling (p. F-13). The DFR should be revised to include more information about if this value was applied uniformly to the entire project area such that oceanfront lots were equal in value to third row lots. A comparison to actual market values for properties

throughout the project area, and whether \$270,000 per acre is a reasonable average or not, should also be provided. Details are needed on whether this land valuation is held constant over the 50 year life of the project, and whether land prices in the project area have been constant for the last 50 years to support such an assumption.

Another economic factor employed in the GRANDUC calculations was beach scraping. In Appendix F the costs for beach scraping are included in the project costs in order to repair dunes damaged by the storms. In Appendix H, however, the costs of beach scraping are used as benefits of the project since scraping is perceived to be no longer necessary with the project (p. H-32). The DEIS cites beach scraping as an impact of the no-action alternative, but the GRANDUC simulations imply that it will occur with the preferred alternative as well. The Corps should clarify whether beach scraping is assumed to occur or not, and if so who will pay for the costs of scraping and how a \$1.55/cy cost was derived. Counting beach scraping as both a cost and benefit of the project is contradictory and inappropriate.

GRANDUC calculated its output based on "maximum storm damage amounts," but the DFR does not define these amounts (p. F-7). The Corps should provide a more comprehensive summary of how this parameter eliminates the potential double counting of multiple storms in a year or loss to long-term erosion. The Service is concerned that this might indicate that only one storm strikes the project area in any given year, and the worst-case storm damage is calculated to allow for multiple smaller storms throughout the year but no larger storms.

Finally, the economic model GRANDUC and its application to this project make other assumptions that may not be realistic. All structures that can be repaired are restored to their original value, for example (p. F-7). Yet property-owners often use the opportunity of rebuilding to upgrade and improve the value of the structure. Repeat losses to the same structure are then likely to be greater because the structure's value has increased. Another assumption that the modelers use is that the renourishment cycle will fully repair all annual and storm erosion damages (p. F-8). A catastrophic category 5 hurricane, though, could destroy the entire project and all the structures in the project area and beyond. New inlets might open in such a scenario, and the erosional losses of beach and island width and elevation might exceed the renourishment volume. This assumption would be invalidated in such situations, as the renourishment as proposed would be unable to fully repair the damages. In the benefits and costs comparison in Appendix H, the GRANDUC results are integrated into the overall project economics. The recreational factors used in the benefit-cost calculations makes a few assumptions that oversimplify reality and overestimate the benefits of the project. The recreational experience assumes "excellent conditions for swimming, fishing, ..." for example (p. H-42). This assumes that the project will not adversely affect fish resources in the surf zone, while scientific studies show that it does. Surf fishing would in reality be impaired at least temporarily immediately following each renourishment cycle. Table H-14 lists an increase in environmental quality with the project, yet no basis or quality

parameters are provided for this assessment (p. H-43). if this factor is based solely on aesthetics, the Corps should provide documentation that the public perceives an artificial beach as prettier than a natural one.

A third assumption that this economic evaluation makes is that human nature does not change over time. No increase in demand or visitation is expected over the 50-year project life (p. H-44). Changes in future development patterns are not included because the Corps states that the oceanfront lots are near build-out (p. H-31-32). The Corps should note that development may occur in the vertical direction, however. The DFR does not discuss whether non-oceanfront lots are near build-out as well. If not, then it is reasonable to assume build-out will be reached within the 50-year life of the project and visitation would increase correspondingly. It is also reasonable to argue that the forecast increase in storminess will discourage development/redevelopment and start a reverse trend of people leaving the project area. The Corps should clarify these assumptions about human nature and how they affect the economic justification for the project.

Overall, modeling used for the economic justification for this project is based upon faulty assumptions and inaccurate representations of existing conditions. The DFR states that "[w]herever relatively inexpensive, single unit housing dominates a segment [of coast], the potential for damaged property within that segment probably fails to cover the costs of its protection" (P. H-16). The North Project Area has a good probability of not being economically feasible in particular. The technical appendices of the DFR do not provide adequate information for the Service to fully evaluate the impacts of the project to fish and wildlife resources. The renourishment interval and volumes are based upon these modeling simulations of GENESIS and GRANDUC, and the severity of the impacts to fish and wildlife resources corresponds with the volume of fill and recovery time between fill episodes.

The Corps' initial analyses of costs (DFR, Tables 6-10, pp. 47-60) do not appear to include any costs associated with biological monitoring. These costs only appear later (DFF, Table 16, pp. 83-84) when discussing the preferred alternative. Monitoring costs should have been factored into the decision on the preferred alternative. Such inclusion would be important because the non-structural alternatives would require relatively minor monitoring costs. The berm and dune alternative would require monitoring for sea turtles on the beach and for benthos within the proposed borrow sites, or for revenues lost due to reductions or disruptions in shore and vessel-based commercial and recreational fishing activities. The berm and dune alternative would also have monitoring costs not only within the project area, but to the extent that any project-induced reductions in fish stocks may be estimable, may require expenditures for fisheries promulgated in areas distant from the project site, such as recreational fisheries for striped bass and weakfish in Chesapeake Bay, and bluefin tuna off New England.

The actual overall cost of nourishing a beach cannot be predicted. A return to a period of increased storm frequency would greatly increase the need for

renourishment and greatly increase project cost. Using "best case scenarios" to predict the cost of constructing and maintaining an artificial berm and dune for 50 years can be misleading. An accurate cost comparison among the alternative is not possible. The Service agrees with the Corps (DEIS, p. 3-1) that such emergency measures as sandbagging and beach scraping are ineffective for halting barrier island recession. However, we also note that the Corps proposed alternative has also generally proven ineffective, since the longevity of beach nourishment projects cannot be predicted. Dean (1999, p. 95) writes that until more is known about how sand moves on the beach, it will be impossible to accurately predict how long any given project will survive.

**Corps Response:** Disagree. The feasibility report and the DEIS provide all the information necessary for the FWS to evaluate the impacts of the project on fish and wildlife. While the FWS has questioned many aspects of the plan formulation process, a specific project has been identified and should be evaluated by FWS.

**4.06.54 USFWS Comment:** The alternatives analysis does not address the economic ramifications of providing protection from smaller storms, but no protection against larger storms. The Ash Wednesday storm of 1962 pounded the Atlantic seaboard with waves as high as 30 feet (Dean 1999, p. 145). It struck at the perigean spring tide, when tides rise highest, and lasted through five high tide cycles. Such a storm will certainly strike the area again, and remove the artificial berm and dune leaving the "protected" structures vulnerable to catastrophic damage. The economics of damage from the largest categories of both northeasters and hurricanes should play a role in selecting the preferred alternative.

**Corps Response:** See previous response to comment 4.06.24 regarding storm surges and frequencies used in the plan formulation process. The Ash Wednesday Storm of 1962 produced a still water level of 8.0 feet above NGVD. This is the maximum still water of record for the area. The plan formulation analysis included storm surges up to 11.7 feet NGVD.

**4.06.54(a) USFWS Comment:** The Service does not agree that the preferred alternative would have no effect on increases in income and employment (DFR, p. 97). We recommend that entry in Table 17 be changed to note that a loss in revenues would occur from reduced tourist visitation and surf and pier angling during project construction and maintenance; and unknown permanent reduction in commercial and recreational fishing and landings from the proposed borrow areas during construction and maintenance.

**Corps Response:** The DEIS section 6.04.3 describes potential impacts to commercial and recreational fisheries. These impacts are believed to be primarily inconvenience to sport and commercial fishermen involving minimal impacts. In most cases, avoidance of the dredge operation and pipeline would not involve additional cost. Therefore, an attempt to measure the costs associated with these impacts for inclusion in the economics of the project was not made.

**4.06.55 USFWS Comment:** The Service concurs with the Corps (DEIS, p. 6-14) that the area available for fishing under the four piers in the project area will be reduced, and that sand placements during the fishing season may reduce the catch and/or fishing activity, due to angler perceptions regarding perceived impacts. The impacts of these alterations should be quantified and included in project costs, as noted above.

**Corps Response:** See response to comment 4.06.54.

**4.06.56 USFWS Comment:** The Service agrees with the Corps (DEIS, p. 6-8) that there will likely be displacement of various species of sport fish, with resultant negative impact to and lost revenues from reduced surf and pier fishing in the area of deposition. These impacts should be quantified and included in the analysis of project costs.

The Service agrees with the Corps (DEIS, p. 6-9) that there will be routine annual displacement of both commercial and recreational fishing vessels in and near the proposed borrow sites. The Corps should, with the assistance of the NC Division of Marine Fisheries, use data from North Carolina's mandatory trip ticket program to study the amount of catch and effort taking place during the pre- and post-project periods, and quantify any reductions which occur, which are attributable to the proposed project. Other additional costs incurred by fishermen as a result of the project, such as increased time and/or fuel consumption resulting from having to avoid dredging equipment, etc., should also be quantified and included in a revised DFR and DEIS.

**Corps Response:** See response to 4.06.76. See FEIS section 6.12 for discussions of the monitoring plan. Monitoring of the suggested topics is not proposed.

**4.06.57 USFWS Comment:** The Corps estimate (DEIS, p. 3-2) of \$300 million to relocate all the oceanfront structures along the same boundaries of the artificial berm-dune project seems unnecessarily high. This figure is used to determine that the relocation alternative is not economically feasible. However, this figure seems to reflect a coordinated movement of all structures over a fairly short time period. All structures would not need to be moved at one time. A phased withdrawal over several decades would, with the use of an appropriate discount rate, reduce this cost figure.

**Corps Response:** See response to comment 4.06.38.

**4.06.58 USFWS Comment: Summary Comments on Selection of the Preferred Alternative** - As occurs in many cases when the Corps evaluates a potential construction project, this case does not provide a range of options among which the Corps can choose to meet the project purpose. All alternatives to constructing the berm and dune system are found deficient and plan formulation was limited to



consideration of beach berm and berm and dune alternatives (DFR, p . 42). The DFR states (p. 42) that the selection of the preferred alternative was based on "engineering and economic analyses conducted during the study." There is no statement that environmental impacts played a role in the selection process.

**Corps Response:** Typical alternatives for shore protection include offshore breakwaters, groin fields, bulkheads, beach nourishment and relocation. Offshore breakwaters and a hardened shoreline alternative such as groins or bulkheads were not considered because of coastal management policies that prohibit hardened structures due to their impacts on adjacent beaches. A beach nourishment project would consist of (1) a beach berm project to control erosion; or (2) a beach berm and dune project to control erosion and reduce wave overwash during storms. "Nonstructural" measures were also considered as required by Federal planning regulations. These measures usually include relocation, evacuation, elevating, or waterproofing of buildings to reduce damageability. The only nonstructural measure that would substantially reduce damages in the project areas is structure relocation. While relocation would reduce damages to structures, it would not prevent loss of property, associated tax values or emergency costs. Given the high costs of moving structures, loss of benefits, and the impracticality of moving over a thousand structures, relocation is an economically infeasible alternative. See also response to comment 4.06.93.

**4.06.59 USFWS Comment:** The Service disagrees with the Corps that the selected alternative represents the optimum solution to hurricane and storm damage reduction (DFR, p. 100). Furthermore, the Service cannot agree with the contention that there are no known areas of controversy with this project (DEIS, p. 1-3). The entire subject of beach nourishment, its costs to society, and whether or not it is even an effective long-term strategy are in fact highly controversial and likely to remain so. It is most interesting to note the implicit valuation of the project by local officials that is buried deep in appendix H. That portion of the document note on page H-7:

"Officials of Dare County, the towns of Kitty Hawk, Kill Devil Hills, and Nags Head, as well as the State of North Carolina, have indicated that they would not undertake large beach nourishment protection for the Dare County Beaches without Federal Participation."

**Corps Response:** Noted. We recognize that many interests do not agree that beach nourishment projects represent a good long-term investment of the Nation's money and are not free of long-term environmental impacts. However, other structural alternatives that would provide the desired level of protection, such as groins and seawalls, have long-term environmental impacts that are far more severe and are, comparatively, far more costly and difficult to undo. Proposing those measures would have been far more controversial. While not everyone agrees that beach nourishment is a good investment, it remains the most widely accepted tool

available today and complies with state coastal management policies, which are considered to be among the best in the nation.

**4.06.60 USFWS Comment:** This implies that those closest to the problem and most familiar with the value of the property to be protected and the forces of wind and wave action on these properties have concluded that the project is economically justified, only if someone else pays for it. The Service recommends the Corps consider and analyze a phased abandonment/retreat nonstructural alternative, which avoids all adverse environmental impacts and entails considerably less costs to society.

**Corps Response:** If a project is economically justified, the Federal Government can participate in the project only if a local sponsor agrees to provide their share of the cost (35 percent for initial construction and 50 percent for future beach nourishment). See response to comment 4.06.38 for a discussion of a phased abandonment/retreat. We do not agree that a comparable nonstructural plan avoids all adverse environmental effects, nor is it less costly.

**4.06.61 USFWS Comment: Impacts on General Fisheries -** The DFR states (p. 37) that the nearshore waters of the project area accumulate juvenile, ocean spawning, estuarine dependent fish and invertebrates in late winter and early spring prior to their transport through Oregon Inlet to the Pamlico Sound. This statement does not consider that organisms using Albemarle Sound also accumulate in the project area. Oregon Inlet is also the only route available for transport of larval and juvenile aquatic organisms from the Atlantic Ocean to Albemarle Sound. The Final EIS should be revised to indicate that organisms that ultimately use both Pamlico and Albemarle Sound estuaries may be impacted by the preferred alternative.

**Corps Response:** The DFR has been modified to reflect that nearshore fishes and invertebrates of the project area that pass through Oregon Inlet will use both Pamlico and Albemarle Sounds.

**4.06.62 USFWS Comment:** Table 1-1 of the DEIS (p. 1-4) contains a list of environmental requirements to which the project is subject. The Magnuson-Stevens Fishery Conservation and Management Act of 1996, as amended (also known as Sustainable Fisheries Act) should be added to the table.

**Corps Response:** This is a good suggestion. The Magnuson-Stevens Fishery Conservation and Management Act of 1996, as amended, has been added to the list.

**4.06.63 USFWS Comment:** The Service disagrees with the statement (DEIS, p. 4-7) that the resources present during the colder months of the year, when project construction is proposed, are "less sensitive" to the impacts of the preferred alternative. We are unsure of the Corps' definition of the term "less sensitive resources," and request that this statement be clarified. While the fishery resources

present in the area may be regarded as less biologically sensitive than the federally-listed species (piping plovers, sea turtles) present during the warmer months, other species of marine mammals (e.g. humpback whales) which are equally biologically sensitive are present. In fact, the level of biological sensitivity of the significant fishery resources present in the study area during the winter months to project-related impacts is relatively unknown, hence the Service recommendation for thorough pre- and post-project studies. With regard to social sensitivity, the Corps need only attend one of the numerous public hearings regarding proposed amendments to the fishery management plans for most of the species present in the proposed borrow areas during the winter months when construction is proposed, to acknowledge that fishermen concerns for these species are equal if not perhaps greater to those for listed species.

**Corps Response:** This sentence was poorly worded and has been modified.

**4.06.64 USFWS Comment:** The Service does not agree with the Corps conclusion (DEIS, page 6-7) regarding the lack of impacts on anadromous and other estuarine-dependent fish. Noise, turbidity and other project-related activities could cause shifts in migratory pathways, and despite the relatively small size of the proposed borrow sites, they are located within an area heavily used by numerous species of commercial and recreational importance. At best, the magnitude of project impacts is unknown and should be documented by pre- and post-project studies as previously recommended.

**Corps Response:** We do not have any reason to believe that migratory fishes will be adversely affected by the proposed project. Migratory fishes are known to pass by many noises and disturbances in harbors all along the Atlantic seaboard as they move up coastal rivers to spawning areas and, with this knowledge, there is no reason to believe that disturbances in the near shore ocean are going to result in significant impacts to this activity. To construe such an impact in the absence of data is sheer speculation. If the Service has any data indicating that significant impacts to migrating fishes result from offshore activities, we would appreciate receiving a copy so that we can use it in future analyses.

**4.06.65 USFWS Comment:** The Service does not agree with the Corps statement (DEIS, p. 6-12) that no significant adverse impact to designated Essential Fish Habitat (EFH) is expected from the project. Such a conclusion is easy to derive in the absence of any data. The project area is likely within designated EFH for a number of species, and project-related impacts will undoubtedly have some impact on the use of the proposed borrow sites by those species. Whether or not these impacts will be of significance can only be determined by conducting the studies recommended by the Service, as the New York Corps District is doing for a project in its jurisdiction (USACOE 1999b).

**Corps Response:** All Essential Fish Habitat issues will be resolved with the National Marine Fisheries Service, the agency charged with administering that

program. If the Service has concerns that the NMFS is not administering that program adequately, those concerns should be taken up directly with them.

**4.06.66 USFWS Comment: Impacts on Offshore Fisheries** - There is a tendency to view all aspects of the ocean as uniform and practically limitless. These viewpoints are not accurate. Both the pelagic and benthic environments of the offshore borrow sites have high ecological value. Woodward (2000, p. 233-234) notes: "In many parts of the ocean, vital ecological activities concentrate in specific locations. Fish and other marine life may gather on a specific part of the seafloor at certain times of the year or of their life cycle to spawn, mature, or feed. These unique areas are the biological factories for the surrounding ocean."

The proposed project is located in a site, which is of great significance to numerous stocks of commercially and recreationally important, cooperatively-managed, Atlantic Coast fish. Stocks of migratory Atlantic sturgeon, bluefin tuna, bluefish, spiny dogfish, striped bass, summer flounder, weakfish and other species gather in large numbers in the nearshore waters of the Atlantic Ocean off the Outer Banks during the late fall and winter months to feed, rest and prepare for spring and summer spawning activities (Atlantic sturgeon, bluefin tuna, bluefish, striped bass and weakfish) or to actively reproduce (spiny dogfish and summer flounder). Several of the species use the area as nursery habitat (Atlantic sturgeon, spiny dogfish, and summer flounder). The importance of the proposed project borrow sites with their associated benthic and schooling prey species to the predatory, migratory adult spring spawners which spend the winter there may be as significant as the importance of southern United States wetlands and their associated food resources (macroinvertebrates and plant seeds) to migratory wintering waterfowl for determining reproductive success in the subsequent spring and ultimately influencing initial year-class strength. Tagging studies document the fact that the fish using the area are not only from North Carolina estuaries and rivers, but also travel there from great distances (e.g., for striped bass, from the Hudson River and Chesapeake Bay tributaries). All of these species presently support or have historically supported highly significant commercial and recreational fisheries on the east coast of the United States, and all of them are the subject of current management plans prepared by either the Atlantic States Marine Fisheries Commission (Atlantic sturgeon, striped bass, weakfish), jointly by the Commission and the Mid-Atlantic and South Atlantic Fishery Management Councils (bluefish, summer flounder), Mid-Atlantic Council (spiny dogfish), or National Marine Fisheries Service and international partners (bluefin tuna). Portions or all of the site have been designated as Essential Fish Habitat for some of these species by the Councils and National Marine Fisheries Service. For these reasons, the Service is seriously concerned that any proposal to alter or modify these highly important wintering grounds be rigorously and conservatively analyzed.

The Service remains concerned that the biological characteristics of the offshore borrow areas would be permanently altered by the removal of 79 mcy of sediment over the 50-year project. The average proposed cut in the southern and northern

borrow areas are 12 feet and nine feet, respectively, with the maximum cuts in these two areas being 20 feet and 12 feet, respectively (DEIS, p. 6-4). The Corps states (DEIS, p. 6-6) that borrow areas can fill in and return to near pre-dredging conditions when there is adequate transport of sediment under the influence of strong currents in the area, and that currents in the area are expected to contribute to some filling of the borrow sites with material from undisturbed areas adjacent to the construction sites.

There are problems with the assumptions that the borrow sites would eventually return to their pre-dredging conditions. The borrow areas at depths of 30-60 feet are beyond the stated closure depth of -27 feet NGVD in the project area (DEIS, p. 3-2). Closure depth is defined as the water depth at which wave action produces no appreciable movement of sediment (National Research Council [hereafter] NRC 1995, p. 8). Therefore, neither alongshore or across shore currents produced by waves can be expected to move bottom sediment into the borrow area. The sediment that is expected to return to the borrow areas is very fine grained material that drops out of the water column. The Service noted (USFWS 1999, p. 119) that:

"The majority of follow up studies from offshore borrow sites have shown decreases in the mean grain size, including, in some cases, increases in the percentage of silts and clays in the borrow site (NRC 1995, p. 118). Offshore holes may fill with finer grain material (NRC 1995, p. 118). The finer material or other significant alterations in the physical characteristics of the substrate may not be suitable for the organisms that formerly occupied bottom sediment of the borrow area."

The Corps assertion that similar material may move into holes created by dredging appears to be at odds with evidence from the area off the coast of Pea Island, immediately south of Oregon Inlet and approximately 5-6 miles south of the project area. From 1983 through 1989, the Corps removed more than 500,000 cubic yards of material per year from the Oregon Inlet ocean bar and deposited it in approximately 20 feet of water off the northern end of Pea Island. The Corps reports (USACOE 1999a, Appendix E, Item 16) that surveys of the offshore disposal sites in 1990 indicated that essentially all the dredged material was still in place. If there has been little, if any, movement of this material in 20 feet of water, the Corps should explain their assumptions and the factors that would move material into the borrow areas at depths of 30 to 60 feet.

**Corps Response:** The material deposited along the 20-foot depth contour south of Oregon Inlet was generally coarser than the material normally located in this depth of water since it was derived from the ocean bar channel of Oregon Inlet. The deposit is no longer present, however, probably having been displaced by the Halloween Day Storm of 1991. The Halloween storm produced the largest period waves ever observed in the project area. These long period waves would have had the capacity to mobilize the coarser grained sediment that was deposited in the area off Pea Island. Accordingly, significant quantities of material can be mobilized at

depths ranging from 30 to 60 feet, however, such mobilization is not an everyday occurrence.

**4.06.67 USFWS Comment:** An important point regarding the movement of fine-grained sediment into the borrow areas should be discussed. If as the Corps postulates, currents would move sediment into the borrow areas, some of this sediment would be coming from the beaches. Some sand placed on the beaches and carried seaward by waves may not stop at the designed closure depth of -27 feet. Large storms may carry fine sand further seaward to depths greater than -30 feet. Sand carried to depths of more than 30 feet could return to the original borrow sites. If sand can be carried back to the borrow sites, the longevity of the nourishment project would be reduced. In essence, sand would be removed from the base of an underwater slope, carried landward and placed at the top of the slope, and then roll down the slope to the place from which it was removed.

**Corps Response:** The general assumption with regard to the fate of nourishment material that is not compatible with the native sand is that this material will be transported seaward. The overfill factor for initial construction of the north project, which would derive its material from N1, is 1.5 while the overfill factor for periodic nourishment of the north project would be 1.2 with the material coming from S1. The south project would be initially constructed and nourished with material from S1. While the proposed borrow areas are located in areas where existing water depths are 40 feet or greater, some of the unsuitable material may work its way back to the borrow areas. Since this material previously resided in these locations, its return should not result in any significant impact.

**4.06.68 USFWS Comment:** A major change in the physical characteristics of offshore bottom substrate would influence the organisms that can live there. The Corps states (DEIS, p. 6-12) that:

"Benthic organisms in areas dredged for construction and maintenance will be lost. However, recolonization by opportunistic species is expected to begin soon after the dredging activity stops. Rapid recovery is expected from recolonization from migration of benthic organisms from adjacent areas and by larval transport. Some changes in species composition and population may occur."

This statement suggests that the organisms which recolonize the borrow areas may be different from those occupying the area prior to dredging. The Service disagrees with the Corps assertion (DEIS, p. 6-19) that the removal of food resources from the ocean bottom in the proposed borrow sites will be temporary. There is no certainty that the post-dredging benthos will have the same food value as pre-dredging populations. While it is true that there may be some level of recolonization, the Service believes that annual disruption of the bottom resulting from initial construction and nourishment activities will cause a net reduction of benthos standing crop from baseline conditions. The Corps should conduct the recommended studies to determine the level of reduction.

**Corps Response:** The post-dredging benthic community which develops in the offshore borrow areas may differ from the pre-dredging community in terms of species diversity, bio-mass, and other characteristics. However, re-population of the area is expected to occur rapidly over a period of months. Since fish that consume benthic organisms tend to be opportunistic feeders and are not generally dependent upon the presence of specific benthic species as critical food sources, changes in benthic community structure do not necessarily result in measurable impacts through the food chain. Nevertheless, the Corps has agreed to monitor project impacts.

**4.06.69 USFWS Comment:** In addition to permanent alterations of the offshore benthic habitats, dredging for borrow material will create turbidity which is harmful as a direct impact and also harmful as a cause of sedimentation at sites distant from the actual borrow areas. The Corps has noted (USACOE 1993, p. 15) that the turbidity associated spring and summer nourishment may be significant and require mitigation. The Service is especially concerned about sedimentation on hardbottoms. The DEIS notes (p. 6-10) that hardbottoms occur "in the project vicinity", but concludes that "if hardbottoms are present they are ephemeral in nature or small in size." The Corps' conclusion fails to consider that many vital habitats, such as water holes in desert areas, are ephemeral and small. The point is that some exist and can be used by mobile species. If hardbottoms constitute a relatively small percentage of the offshore bottoms and are constantly appearing in some areas and disappearing in others, these facts do not diminish their importance.

**Corps Response:** The EIS adequately addresses the impacts of sedimentation at sites distant from the actual borrow areas, particularly hardbottom habitats. The importance of these resources in areas where they occur is documented in Section 5.01.2 Hardbottoms of the EIS. As indicated in the EIS, SEAMAP (South Atlantic Bight Hardbottom Mapping, Southeast Monitoring and Assessment Program) reported hardbottom and potential hardbottom records (from 1972) between proposed borrow area S1 and the beach at Nags Head. Five previous and 13 subsequent surveys of that area did not identify hardbottoms. Sediment core and side scan sonar surveys of proposed borrow areas did not reveal any hardbottom habitat in those areas. The Corps consulted with a scientist knowledgeable about the SEAMAP information. Dr. Steve Ross stated that the designation of a hardbottom or potential hardbottom may be based on the presence of black sea bass that can occur on non-hardbottom, north of Cape Hatteras. This suggests that the designation as hardbottom may have been erroneous. No verified hardbottom records are known for the project area. The statement regarding small, ephemeral hardbottoms has been deleted from the EIS.

The turbidity effects will be localized to the dredging location. The major factors influencing the strength of the turbidity or sediment resuspension source at the dredge are the sediment type being dredged, the dredge plant and manner in which it is operated, and ambient currents. If the sediment is primarily sand, material may

be released to the water column, but it quickly settles out. The beach fill material to be dredged is primarily sand.

**4.06.70 USFWS Comment:** The presence of fine grained material within the proposed borrow sites poses a risk to hardbottoms over a wide area. In his review of the Corps' data, Dr. Robert Dolan noted (USFWS 1999, p. C-9) "[t]he percentage of fine sediment within the vibracores collected from offshore should be of concern." While this statement was directed at the compatibility with existing beach sand, fine grained material would be carried farther away from the borrow site than larger grained material. Bush et al (1996, p. 83) state their belief that the dredging of sand off Boca Raton, Florida, for a new beach released mud that was responsible for killing coral heads more than 20 miles to the north.

**Corps Response:** We disagree that presence of fine-grained materials within the proposed borrow areas poses a significant risk to hardbottoms over a wide area. Grain size analyses were conducted on sediment samples collected from the vibracores. Mean grain size of the borrow areas ranged from 0.34 mm for S1 to 0.22 mm for N1. The fines are included in these computations. The response to the previous comment discusses hardbottoms in the immediate project area. In addition the SEAMAP, South Atlantic Bight Hardbottom Mapping indicates hardbottoms off North Carolina are clustered in specific areas particularly off Onslow Bay and Long Bay. Only a few SEAMAP data records classified as hardbottom occur north of Cape Hatteras. The benthic communities off Dare county have been described as a mobile sand sheet (Cerame-Vivas and Gray, 1966, Day et al., 1971, Wigley and Theroux 1981, Weston, 1988). Considering the information that benthic communities are sand bottom communities, and the sediment resuspension effects will be localized to the immediate project area, adverse impacts to hardbottoms well beyond the immediate dredging and beach fill area are not considered to be likely occurrences. Comparing project impacts of this marine community to that reported in the marine environment off Boca Raton, Florida is not valid.

Cerame-Vivas, M.J. and I.E. Gray. 1996. The distribution pattern of benthic invertebrates of the continental shelf off North Carolina. *Ecology* 47:260-270.

Day, J.H., J.G. Field, and M.P. Montgomery. 1971. The use of numerical methods to determine the distribution of the benthic fauna across the continental shelf of North Carolina. *Journal of Animal Ecology*, 40:93-125.

Wigley, R.L. and R.B. Theroux. 1981. Atlantic Continental Shelf and Slope of the United States – Macrobenthic Invertebrate Fauna of the Middle Atlantic Bight Region – Faunal Composition and Quantitative Distribution. U.S. Geological Survey Professional Paper 529-N.

Weston, D.P. 1988. Macrobenthos-sediment relationships on the continental shelf off Cape Hatteras, North Carolina. *Continental Shelf Research* 8(3):267-286.



**4.06.71 USFWS Comment:** Due to the risk of significant alteration in bottom sediment characteristics and benthic populations inhabiting the area, the Service does not concur with the Corps (DFR, p. 86) that "since stable, productive bottom will be avoided, there should be very little impact associated with the borrow areas." In addition to the fact that the Service has provided some data which indicate that in some years, striped bass consume as much as 12.8 percent prey which are somewhat dependent on benthos, there are additional species such as spiny dogfish and summer flounder which are much more dependent on benthic species as prey and are therefore likely to be more greatly affected. The wholesale removal of the benthic prey base from the sites during initial construction, as well as the reconfiguration of the bottom within seven square miles of habitat in these important wintering grounds during the course of the 50-year project life, is likely to have at least a localized impact on the use of the proposed borrow sites for resting, foraging and spawning activities by adults and resting and foraging by juveniles. The Corps should conduct the requested studies to assess the level of impact which occurs.

**Corps Response:** See response to comment 4.02.2 above. The Corps will address these issues through the development of an integrated pre- and post-construction monitoring plan as described in FEIS Section 6.12. This plan will be developed during 2001 through coordination with all interested agencies or individuals, and monitoring should be implemented in 2002. This will be two years prior to project construction scheduled for 2004.

Except for an offshore borrow area not being involved, a similar integrated monitoring plan for beach disposal actions on several beaches in Brunswick County, North Carolina is currently being coordinated and should be implemented in late 2000 and early 2001. Information gathered from this coordination and monitoring effort will be helpful in the development of the monitoring plan for Dare County. Scientific knowledge on the impacts of beach disposal will be greatly enhanced from these two monitoring efforts at the opposite ends of North Carolina's coastline. Enough information will be available by 2004, through the results of these efforts along with past and other ongoing monitoring related to beach nourishment activities, in order for construction of the Dare County project to begin.

**4.06.72 USFWS Comment:** Offshore dredging is likely to adversely impact fish by forcing them to leave traditional habitat. The Corps states (DEIS, p. 6-7) that "[f]ish species are expected to leave the area temporarily during the dredging operation and return when dredging ceases . . ." The impact of this exodus could be considerable, if it causes fish to leave productive wintering grounds where they are resting and feeding in preparation for spring spawning migrations. Impacts may be particularly severe during the fall/winter of 2003-2004, when project construction is scheduled to occur for much of the year, if fish are not able to find resources in areas other than the proposed borrow sites. The Corps should fund the recommended studies to determine the level of impact which occurs.

**Corps Response:** The Corps has agreed to monitor project impacts as described in section 6.12.2 of the FEIS.

**4.06.73 USFWS Comment:** Although dredging equipment may be able to detect and avoid marine mammals (DFR, p. 89), neither mammals nor fish present in the area will be able to avoid, except through departure from the area, the noise generated by the dredging equipment. The Corps should assess in future project documentation the levels of underwater noise generated by the dredging operations, and the expected impact upon marine mammals and fishery resources present in the area. At a minimum, the Corps should document expected levels of noise, and conduct a literature review to assess the likelihood that marine mammals and fish may be driven from the project area. Potentially, noise impacts could impact a wider area than the immediate footprint of sand removal, transport and deposition activities. The Corps should be able to determine the potential area impacted by noise disturbance. This information should be provided in a revised DFR and FEIS.

**Corps Response:** We disagree that a complete analysis of this issue needs to be included in the EIS. Over the years, noise issues in the marine environment have been thoroughly addressed by the National Marine Fisheries Service and they have not indicated that any problems are expected from the proposed dredging. Based on our experience, we do not expect any noise impacts either. If the Service believes that the NMFS is not adequately protecting marine resources from noise impacts, they should take this issue up with that agency directly.

**4.06.74 USFWS Comment:** Overall, the Service believes that the long-term impacts on the offshore benthos, both flora and fauna, as well as the important fisheries resources have not been adequately addressed. While the Corps acknowledges (DFR, p. 96) the "destruction and displacement" of offshore benthos, such impacts are considered "temporary." The fact that such "temporary" impacts would occur every year for 50 years, and probably forever, has not been adequately considered. The initial elimination and reduced production of borrow site benthos and impaired use by fish for resting, foraging, spawning and nursery area for a 50-year period may produce serious consequences.

**Corps Response:** Complete and permanent elimination of all benthos from borrow areas is not a reasonable expectation. We recognize that there is uncertainty regarding recolonization, both the rates at which it will occur and the species composition of the reestablished community. Because of that uncertainty, we have agreed to monitor project impacts.

**4.06.75 USFWS Comment: Impacts on Nearshore and Surf Zone Fisheries -** The Service is concerned that material placed on the beaches will be carried away from the beaches over the years and cover productive hardbottoms far removed from the disposal site (USFWS 1999, p. 117). The Corps contends (DEIS, p. 6-11) that potential hardbottoms are located beyond the closure depth (the depth at which movement of bottom sediment is negligible) and should be unaffected by disposal

operations. However, there is evidence indicating that all the sand placed on Wrightsville Beach, North Carolina, from the mid- 1930s to the early 1990s is now on the inner continental shelf, seaward to the closure depth used by the Corps (Riggs 1994). Most of the sand pumped onto the beach, estimated to be about 7 mcy, has now buried extensive hardbottoms on the inner continental shelf these hardbottoms were once prime fishing spots, but are now buried with two to six inches of sand and out of production (Riggs 1994).

**Corps Response:** While the report by Riggs attributes the material on the ocean bottom off Wrightsville Beach to the beach nourishment project, the volume of material covering the offshore bottom Riggs attributes to the project does not agree with the volume of material placed on this beach since 1964. Since 1964, approximately 10.3 million cubic yards of material have been placed on Wrightsville Beach. Monitoring of the project area and the beach to the north as well as surveys of the sediment trap in Masonboro Inlet are able to account for most of this material. The volume of material we believe was transported off of the project to the offshore waters is around 1.6 million cubic yards over the entire 35 year history of the project. While this volume is substantial, it is considerably less than the volume of material that Riggs attributes to the project.

**4.06.76 USFWS Comment:** The Service agrees (DFR, p. 86) that there will be "...a negative impact to surf fishing in the area of deposition." However, the two tables comparing alternatives (DFR, Table 17; DEIS, Table 4-3) fail to mention the economic impacts of sand disposals. The DFR (p. 97) does not mention any adverse contributions of the selected plan on income and employment.

**Corps Response:** The DEIS section 6.04.3 describes potential impacts to commercial and recreational fisheries. These impacts are believed to be primarily inconvenience to sport and commercial fishermen involving minimal associated costs. In most cases, avoidance of the dredge operation and pipeline would not involve additional cost. Therefore, an attempt to measure the costs associated with these impacts for inclusion in the economics of the project was not made.

**4.06.77 USFWS Comment: Impacts on Beach Invertebrates** - The Service expressed concern about the adverse impacts of sand placement on beach invertebrates (USFWS 1999, p. 117) and recommended (USFWS 1999, p. 152) that the Corps assess the impacts of the preferred alternative on these important components of the food chain. The Corps acknowledges (DFR, p. 96) that initial construction and periodic renourishment would cause the "destruction and displacement of intertidal and benthic fauna." The Corps notes (DEIS, p. 6-13) that

"While beach disposal may produce negative effects on intertidal macrofauna, these are localized in the vicinity of the disposal operation. Beach disposal conducted as a component of the proposed action could occur year-round during construction, but would be expected to move along the beach at a relatively slow rate. This rate of progress is slow enough that surf-feeding fishes and shorebirds may move to other

areas that are not affected by the disposal operation.... As the dredging operation passes by a given section of beach, that area is soon available for recolonization by invertebrates."

**Corps Response:** See response to comment 8.01.39.

**4.06.78 USFWS Comment:** The Service is concerned that these statements do not adequately address the adverse impacts of nearshore turbidity resulting from sand placement. These adverse impacts were discussed by the Service (USFWS 1999, p. 116-117; 120-122). First, the "negative effects" mentioned above are actually complete mortality. Second, invertebrates population recover slowly on beaches receiving sand (Reilly and Bellis 1978, p. 83). The adverse impacts of sand placement are not limited to the actual disposal site. Sand placement can produce: (1) failure of adult intertidal organisms to return from their nearshore over-wintering refuges; (2) reduction in organism densities on adjacent beaches; and, (3) inhibition of pelagic larval recruitment efforts (Reilly and Bellis 1978, p. 83). Proposed construction and nourishment activities which will occur on 14.8-miles of beach initially, and on shorter stretches thereafter, regularly during the winter months for 50 years, will undoubtedly result in a net reduction of standing crop, if not productivity, when compared to the baseline conditions in the project area. The net project impact appears to the Service to be widespread, long-term, and of questionable reversibility.

**Corps Response:** The discussion of turbidity impacts in the beach fill placement area has been expanded in the EIS. While the project area includes approximately 14 miles of beach, the beach fill placement will take place only at one or two locations at any one time, and each site will comprise a relatively small zone of impacts as the sand placement operation proceeds along the beach.

The discharge of dredged material on the beach will increase nearshore zone turbidities. The turbidity in the plumes is expected to be similar in magnitude to conditions encountered during storm events. However, the spatial extent of elevated turbidities associated with beach fill will be relatively small. Van Dolah et al. (1994) determined the spatial extent of turbidity plume associated with a beach renourishment at Folly Beach, South Carolina. They found that the turbidity plume as determined by measurements of NTUs extended approximately 1,000 m in a down longshore current direction at a distance of 15 m from shore and 500 m at a distance of 30 m from shore. Turbidity levels were variable depending on local weather conditions. During periods of calm winds and seas, turbidities of about 100 NTUs were measured at the discharge. Measurements of a beach fill action in New Jersey revealed similar results (USACE New York District 1999). The impacts from turbidity generated from beach fill activities are not expected to be significant.

**4.06.79 USFWS Comment:** Project documentation does adequately describe the various impacts to beach invertebrates. The Summary of Plan Effects in the DFR (p. 96) notes that effects will be temporary, but will recur over the life of the project -

perhaps a contradiction in terms. The comparison of impacts in the DEIS (Table 4-3) notes that the no action alternative would continue to impact beach invertebrates due to private beach bulldozing and sandbag installation. The Corps assumes that "existing conditions allow little time for full recovery . . ." If "existing conditions" refer to the relatively small scale of beach bulldozing and sandbagging, it is difficult to see how these operations would be so harmful while placing 79 mcY of sand on beaches over 50 years would only produce "temporary" impacts and allow for recovery. The assessment of the no action alternative fails to consider that there could be a resumption of natural beach recession that would greatly benefit beach invertebrates and the birds and fish which feed on them.

**Corps Response:** We disagree that beach bulldozing is being performed on a small scale. In some portions of the project area, it is very widespread and occurs annually, allowing only one year for recovery before a repeat event occurs. With beach nourishment, beach bulldozing would cease and disturbance events would occur only every three years. You are correct in asserting that if beach bulldozing ceases, natural beach recession would resume and many natural resources would benefit. However, given the economic investment of most beach property owners, cessation of beach bulldozing in the project area is unlikely in the readily foreseeable future. See response to comment 8.01.39.

**4.06.80 USFWS Comment:** Migrating birds may rely on the peak abundances during a short period in the summer. If the abundance of beach invertebrates are greatly depressed along several miles of beach, even for a week, this may have more significant impact on their dependent populations than a lag in recovery the following season (Donoghue, 1999, p. 184).

**Corps Response:** Note that Dr. Donoghue (1999) states "may have," not "will have." This is legitimate speculation on her part and should not be construed as fact by the Service. Regardless, we are not aware of any evidence that populations of migrating shorebirds are being seriously limited by diminished beach food reserves. If the Service has studies or reports that document the significance of this impact we request that they be made available so that the information can be incorporated into future studies.

**4.06.81 USFWS Comment:** The DEIS (p. 4-7) notes that between periodic nourishment, the towns would continue to make repairs to the beach fill following storms. This work would consist primarily of reshaping the fill cross-section using material displaced from the upper portion of the profile or hauled in from some outside source. The Corps should identify how much and from what source(s) sand may be hauled in by the towns to make repairs to the beach fill following storms. The Service views this as an additional direct impact of the proposed project which should be quantified and included in a revised DFR and DEIS.

**Corps Response:** The amount of material required to rebuild the upper portions of the project profile following storms was based on estimated volumes that would be eroded from the profile above the 0-foot NGVD elevation. The quantity of material varies from year to year depending on the frequency and intensity of storms. Generally, the volumes would range from 5 to 10 cubic yards per foot of beach.

**4.06.82 USFWS Comment: Adverse Impacts on Navigation at Oregon Inlet -**

The Service expressed concern (USFWS, pp. 147-148) that the predominant north-to-south longshore current would carry sand from the project area to the Oregon Inlet navigation channel, approximately 5 miles south of the boundary between Nags Head and the national seashore (USFWS 1999, Figure 9, p. 19). Shoaling produced by project sand could close the navigation channel. A single severe storm could wash thousands of cubic yards of new sand off the Dare County beaches project area southward to the Oregon Inlet navigation channel in a relatively short time (USFWS 1999, p. 147). Without adequate planning and resources for additional dredging the channel would become blocked to commercial fishing vessels. To address this problem, the Service recommended that all interested parties sign a Memorandum of Agreement that would clearly establish the procedures to be used and the methods of funding for both increased maintenance and emergency dredging.

Movement of sediment away from a nourished beach may accelerate the filling of navigation channels in down current areas, which could increase the frequency of dredging required to maintain the channel (NRC 1995, p. 113). The intense wave action in the area transports large amounts of sand toward Oregon Inlet, and much of this sand is trapped in the inlet environment, resulting in the development of massive shoals (USACOE 1999a, EIS, p. 2-2). The Corps has had difficulties maintaining the authorized Oregon Inlet channel due to shoaling. The Corps states (USACOE 1992, p. 3):

"The Oregon Inlet Channel in the vicinity of the Bonner Bridge and the channels west of Bonner Bridge are subject to frequent migration and rapid shoaling. Shoal in these channels are characterized by small-scale, shallow humps which stop virtually all -- navigation. These shoals are unpredictable and hazardous and require immediate response by a dredge. Since intensive hopper dredging started at Oregon Inlet in 1983, the controlling depth in the bar channel have equaled or exceeded the authorized depth of 14 feet only 24% of the time (USACOE 1999a, Appendix E, p. 3). The average cost of maintaining the entrance channel since 1983 has been slightly over \$5 million per year. Even a ten percent increase in annual dredging costs would require an average annual increase of \$50,000 for work at the inlet.

However, the Corps expects some sand to be pushed south of the project area. The DEIS notes (p. 6-5/6-6) that "[s]horeline modeling shows that the beach fill can be expected to spread into the CHNS [Cape Hatteras National Seashore] for 6,000 feet beyond the transition area under average wave conditions. This would place the

extent of the dispersed sand about 9,000 feet [1.7 miles] south of the CHNS boundary." The DEIS also notes (p. 6-1) that 1-2 miles of beaches within the Cape Hatteras National Seashore will receive sand "indirectly" due to littoral transport from adjacent construction areas.

The assertion that a very limited amount of sand would be carried south by the longshore transport system is apparently based on the assumption that sand would be moved directly seaward rather than along the shoreline. The DEIS states (p. 6-8) that "[m]ost of the fine material in the beachfill is expected to be washed seaward into the surf zone during construction and maintenance." The DEIS also notes (p. 4-7) that "[a]s with the existing conditions, material placed on the beach is expected to be eroded from the upper profile and displaced seaward to form an offshore bar parallel to the shoreline during storm events." Any southward movement of sand is expected to stop prior to reaching the Oregon Inlet area.

The Service has concerns about the Corps analysis of the risk to navigation at Oregon Inlet. As noted, we question the Corps' modeling results that predict only a small amount of additional sand that will move south with the predominant longshore current. The project plan now estimates that approximately 4.16 mcy of sediment will need to be added to the beaches every three years (DFF, p. 64), an average annual loss of about 1.4 mcy. If this material must be replaced, it has moved from the location where it was originally placed. Some sediment will move offshore and some sediment may even be blown inland. However, it is the sediment which moves south that is the greatest concern to the Service. The Corps' estimate that only 65,000 cubic yards (1.6%) of additional sand will traverse the 4-5 miles to the Oregon Inlet navigation channel seems questionable.

An case study from Florida suggests that alongshore movement may be extensive (NRC 1995, pp 200-201). Delray Beach is an example of a beach nourishment project where spreading losses represented the greatest component of the erosion rate on the nourished beach. The beach was nourished in 1973 with 1.57 mcy of sand. Prior to the project, the beach was eroding at a rate of 19,620 cubic yards per year. From 1973 through 1978 the beach eroded at a rate of 91,560 cubic yards per year. The beach was renourished in 1978, 1984, and 1992. The erosion rate (the entire profile) was again about 91,560 cubic yards per year from 1978 through 1984. Between 1984 and 1992, losses moderated and averaged 45,780 cubic yards per year. The NRC (1995, p. 201 based on Beachler 1993) stated that **'over half of the sand lost from Delray Beach can be accounted for as accretion on adjacent beach . . .'** [emphasis added]. This study is noted as an example of the importance of estimating spreading losses in the design of beach nourishment project.

Dean (1999, p. 60-61) describes the movement of nourishment sand away from Hunting Island State Park, South Carolina. After a sand-pumping operation placed sand on the narrowing beaches of the park, the sand washed away and moved southward to the beaches of Fripp Island. In 1968 approximately 650,000 cubic yards of sand were placed on park beaches, but almost all this material was gone

within 18 months (Dean 1999, p. 107-108). While this sand movement provided a brief respite for the beaches of Fripp Island, sand washed off any created beach may aggravate navigation through downdrift inlets.

If the beaches south of the proposed disposal area are in equilibrium with the existing wave forces, there is no reason to assume that the southward drifting sand would come to a halt before reaching Oregon Inlet. It is likely that project sand placed on beaches would continue to move south to the Oregon Inlet navigation channel.

While the Service believes that much more than an additional 65,000 cubic yards of sand could reach the navigation channel in any given year, especially as a result of major storms, there is another factor to consider. Even a small amount of sand could close the navigation channel. Using the same statistical logic which allows a man to drown in a lake with an average depth of only six inches, the Corps assertion that an average of only 65,000 additional cubic yards of sand would reach the inlet annually does not consider the wide range in sand transport volumes that is possible. A season of severe storms could move several hundred thousand cubic yards of additional sediment to the vicinity of the navigation channel. The overriding problem is not so much the exact amount of sand that would be carried to the navigation channel, but the risk that the channel would be closed or that a vessel would run aground if only a small section of the channel experienced shoaling. The Corps has not considered this impact to the human environment, i.e., the fishermen that must pass through the inlet. Therefore, the DEIS is deficient in this respect.

The Service has three recommendations regarding the possible closure of the Oregon Inlet navigation channel. First, the Final EIS should go beyond merely considering the cost of dredging the Oregon Inlet navigation channel and acknowledge that sand from the project could close this important commercial passageway. Closure of the navigation channel is an impact on the human environment, and must be addressed in the NEPA planning process. The Corps should estimate how frequently the channel might be closed and the duration of these closures. The Corps should also estimate the lost income to fishermen that use the navigation channel.

Second, the Final EIS should include details of all the models and data inputs used to predict movement of sand. These disclosures should be made available to independent geologists and engineers to allow them to verify or critique the Corps' findings.

Third, the Service seeks a clear understanding among all the parties with an interest in navigation through Oregon Inlet. These parties include the Service, the Corps, the National Park Service (NPS), and especially the Oregon Inlet and Waterways Commission (OIWC), a body of the Dare County Government, which has spoken on behalf of commercial fishermen. The concerns of the Service and the NPS are clear. A prolonged closure of the Oregon Inlet navigation channel would create a crisis and



demands for construction of the controversial dual jetty system at the inlet. The Service is insistent that such a crisis not be allowed to occur. All parties must acknowledge that massive sand placements in the project area pose a risk to the navigation channel. All parties must acknowledge the capabilities and limitations of the Corps in keeping the navigation channel open. The Corps should clearly state the procedures and funds that would be used to open and maintain the navigation channel. These procedures must be acceptable to the Service, the NPS, and OIWC. The concurrence of the OIWC is essential. Overall, the Service seeks formal assurances that any increase in the closure of the navigation channel will not be used to demand construction of the jetties. Without such an agreement, formalized in a Memorandum of Agreement (MOA) among the parties, the Service must consider construction of the Oregon Inlet jetties as an indirect impact of the Dare County Project and a feature which must be considered in the EIS of the storm damage reduction project.

**Corps Response:** The Corps disagrees with the USFWS assessment of the impacts of the Dare County Beaches project on shoaling in Oregon Inlet. We stand by our analysis and assessment presented in the feasibility study and FEIS. Any increased shoaling of the Oregon Inlet navigation channel would be minor and would not occur immediately following construction of the project. The maximum potential increase in shoaling discussed in the FEIS would take 50 years to occur and would only develop as material is removed from potential borrow area S1.

**4.06.83 USFWS Comment: Cumulative Impacts of Constructing an Artificial Berm and Dune** - An accurate discussion of the cumulative impacts of the project is important. The preferred alternative seeks to essentially replace the natural beach and its adjustment to a rising sea with a static artificial beach and dune constructed with offshore sand. While the constructed shoreline may resemble a natural beach, an artificial beach does not have the same habitat values as a natural beach. This loss of the natural beach must be placed in the context of other sand placements.

The DEIS (p. 6-2) discusses other beach disposal projects within North Carolina. The list of potential projects in the state omits several projects that have had, or are likely to have, adverse impacts on natural beaches. The ongoing disposal operations on Atlantic Beach is omitted. The disposal operation related to enlargement of Wilmington Harbor that will begin soon has also been omitted. A discussion of these and other reasonably foreseeable beach nourishment projects and cumulative impacts on the environment is a requirement of CEQ's implementing regulations for NEPA compliance.

**Corps Response:** The cumulative impacts analysis has been revised in the FEIS. Please see Section 6.11.

**4.06.84 USFWS Comment: NEED FOR ENVIRONMENTAL MONITORING:** Creation of an artificial berm and dune on the Outer Banks represents an engineering effort that requires special attention to environmental monitoring. The

project area is a high energy coast that differs from ongoing beach nourishment projects such as Carolina Beach and Wrightsville Beach in the southern part of the state. It is important that any adverse environmental impacts be detected early in order that design modification can be made and/or mitigation measures can be initiated.

The Service is pleased that project plans contain some quantitative benthic sampling within the offshore borrow areas (DEIS, p. 6-22). The Corps should provide a detailed plan of the proposed benthic monitoring plan for the proposed borrow sites for review by the Service and inclusion in the revised DFR and DEIS. The proposed study should be sufficiently designed to detect changes in benthic diversity and productivity which may occur as a consequence of project construction. Postproject monitoring should be added as a component of the study, as previously recommended by the Service.

The Service recommends that the Corps ensure that the total area of hardbottoms is not reduced as a result of the preferred alternative. Maintaining these important habitats would require determining the pre-project area of existing hardbottoms and periodic surveys to determine the changes in area. The Service is pleased that the Corps proposes (DEIS, p. 6-22) to assess "[t]he current status of potential nearby hardbottom areas." However, any plans for offshore dredging should include a commitment to monitor hardbottoms within a specified distance, up to 15 or 20 miles, from the dredge site. Both pre-dredging and post-dredging surveys should be incorporated into project plans. Project plans should also include a procedure, such as "dustpan" or thin layer dredging, as a **remedial measure to maintain** the present areal extent of hardbottoms.

The Service also appreciates the Corps commitment to study beach nourishment impacts to surfzone fishes in Brunswick County. This effort is scheduled to begin in December 2000 as part of the Wilmington Harbor expansion project. However, most of this project represents a one-time dredged material disposal operation and is not comparable to the long-term systematic sand placements proposed for Dare County. Studies from Brunswick County are not acceptable to the Service as a substitute for studies conducted in the project area. Dare County is situated in an entirely different biogeographic zone than Brunswick County, with resultant differences in species diversity and seasonal occurrence. The Corps should duplicate the studies proposed in Brunswick County within the Dare County project area.

The Service recommended that a monitoring program for beach and subtidal invertebrates be a part of the construction and maintenance of an artificial berm and dune system (USFWS 1999, p. 152). The Corps responded (DEIS, p. 8-7) that the impacts of beach disposal on beach invertebrates had been well documented and no program was proposed for the project. While the short-term impacts have been documented, the most important issue involves the ability of these invertebrates to recolonize a given disposal area and maintain adequate population levels through decades of periodic decimation. The Service noted (USFWS 1999, p. 12 1) the

position of the NRC (1995, p. 115) that studies have documented only limited or short-term alterations in abundance, diversity, and species composition of nearshore infaunal communities sampled off new beaches (NRC 1995, p. 115). However, several of these studies had inadequate sampling designs that may have precluded detection of significant alterations in the populations or community parameters measured (Nelson 1991, 1993). The NRC (1995, p. 115) concluded that "... efforts should be directed toward obtaining a better understanding of functional changes in the trophic contribution of benthic assemblages to the fish and crustaceans species that rely on the benthos as a major food resource." There should be a requirement to quantify changes in biomass and community composition at one-, three-, five-, and ten years after initial construction. If an assessment indicates a significant decline in either biomass or the number of species present when compared to control areas, there should be definite procedures in place to mitigate for this community. Therefore, the Service reiterates the need for long-term studies of beach and subtidal invertebrates if the preferred alternative is implemented.

The Service appreciates the Corps' commitment (DEIS, p. 6-23) to provide us with the coordinates of the excavated portions of the offshore borrow areas. However, the Corps should plan and provide funding for additional fish sampling in the study area above and beyond that conducted during the annual SEAMAP Cooperative Winter Tagging Cruise. The purpose of the SEAMAP cruise is tagging fish, not conducting the systematic sampling required to detect changes which may result from project construction, although such an element could perhaps be added to the purpose of the cruise, given adequate ship time and funding. The Corps should contact the Service and NNUS for further discussions regarding this issue.

Current documents do not consider losses in income and employment from reduced fishing opportunities as a result of sand placement on area beaches. The Corps should conduct studies to measure the impact and compute costs associated with this impact as well as any lost revenues from impacts to fishing on the four piers located in the project area.

In light of the extensive monitoring that has been proposed by the Corps and additional work recommended by the Service, the annual budget of approximately \$7,569 for annual environmental monitoring (DFF, p. 84) seems too low. Corps estimates of annual environmental monitoring costs should be revised to reflect the costs of studies similar to those currently being conducted by the New York District for the Asbury Park to Manasquan Section Beach Erosion Control Project (USACOE 1999b).

**Corps Response:** See response to paragraph 4.02.2 above. Also, hardbottom areas will be avoided and therefore not impacted.

**4.06.85 USFWS Comment:** The Service recommends that the Corps review the following editorial notes:

Page 90, paragraph 1: The spellings "aesthetic" and "esthetic" are employed interchangeably throughout the DFR and DEIS. One or the other should be selected.

**Corps Response:** Noted.

**4.06.86 USFWS Comment:** DFR, pages 80-82, Table 15, p. 87: The word "tiling" should be replaced with the word "tilling" throughout the DFR, unless in fact the Corps proposes to tile the beach, in which case the Service should reassess project impacts.

**Corps Response:** Noted. The change has been made.

**4.06.87 USFWS Comment:** DEIS, Figure 4-4: The word "Occurance" in the title is misspelled.

DEIS, page 5-2, paragraph 1: The "The" preceding "North Carolina" should be deleted.

DEIS, page 5-2, paragraph 4: "Variabilus" should be "variabilis."

DEIS, page 5-7, paragraph 1: Insert a comma between the words "mackerel" and "amberjack" in the last line.

DEIS, Table 5-3, p. 5-9: A useful modification to this table would be to include the responsible management authority (i.e., ASMFC, MAFMC, SAFMC, etc.) in an additional column.

DEIS, page 5-13, paragraph 4: The text should be corrected to read "...between 1988 and 1997

DEIS, page 5-26, paragraph 5: "Has" should be "have."

DEIS, page 6-1, paragraph 3: " .....transport on sand ..... " should be "transport of sand in paragraph 4, add "to" after the word "similar."

DEIS, page 6-9, paragraph 1: The word "shoreward" in line 1 should be "seaward."

DEIS, pages 6-13 to 6-14: Some text appears to be missing between the bottom of page 6-13 and top of page 6-14. The missing text should be added to a revised DEIS.

DEIS, page 6-15, paragraph 1: The word "generated" should be inserted after the word "turbidity" in line 2.

DEIS, page 6-20, paragraph 1: The Service is unaware of any "...recent prohibition on taking any species of sturgeon less than 3 feet in length..." The provisions of the Shortnose Sturgeon Recovery Plan (NMFS) and Amendment I to the Interstate Fishery Management Plan for Atlantic Sturgeon prohibit the taking or possession of any species of sturgeon on the entire Atlantic Coast. While we agree with the Corps that these plans will help to protect both shortnose and Atlantic sturgeon from fishing pressure, poaching still occurs and remains an ongoing concern, as does bycatch in commercial fisheries.

**Corps Response:** Thank you for making these comments. We have modified the document to reflect these changes.

**4.06.88 USFWS Comment:** Our review of the project planning documents has identified several aspects of the NEPA planning process that have not been adequately addressed. The Service has attempted to clearly outline these deficiencies and recommend ways for bringing these documents into compliance with NEPA. The Service encourages the Corps to implement the important changes given in detail above and summarized below.

**First,** the Corps should clarify the need for action. While it is clear that oceanfront structures are susceptible to both storm damage and the gradual effects of shoreline adjustment, it is not clear whether the Corps seeks shoreline stabilization independent from damage to structures. If shoreline stabilization is sought to preserve oceanfront structures in their present location, the overall project need should be simplified to reflect the goal of preserving these structures. If shoreline stabilization is sought to reduce damage to structures, it is redundant to mention it in addition to damage reduction. If there is a secondary goal of arresting shoreline adjustment without regard for existing structures, the justification for this goal must be explained. The planning effort should also explain that the phenomenon referred to as beach "erosion" is actually the natural shoreline adjustment of barrier islands to a rising sea level. Project planning should eliminate all references to a need to restore the recreational beach destroyed by the ocean. The ocean may move the beach, but it does not destroy the beach. Any reference to the recreational beach should note that action is only needed to determine where the beach will be, not whether it will exist. If there is a need to create a sense of permanency to structures that might otherwise be considered temporary, this should be noted.

**Corps Response:** The purpose of the project is to reduce damages caused by coastal storms and beach erosion. By law, damages associated with long-term shoreline recession are included as storm damages. As discussed in responses to previous comments, the barrier islands are eroding as there is less land mass on the islands today than there was during the mid 1980's. While sea level rise is a causative factor in shoreline recession, it is not necessarily the dominant factor. Finally, the project will preserve a useable recreational beach whereas a continuation of the historic shoreline recession will result in the sequential failure of

numerous structures along the project area along with the attendant litter and pollution of the beach and nearshore waters.

**4.06.89 USFWS Comment: Second,** the DEIS provides only a vague outline of the project purpose. The documents do not respond to the recommendation of the Service that the purpose should state: (1) the level of storm for which protection is sought; (2) the types of damage which should be reduced; and, (3) the specific areas for which protection should be provided. Without specific goals there is really no way to measure the success of the project. Furthermore, an ill-defined purpose does not provide the necessary foundation for developing and evaluating alternatives. The Final EIS must provide clear goals for the federal action, even if these goals cannot be achieved at the present time.

**Corps Response:** Disagree. The purpose of the plan is clearly described. Also, the plan has been formulated in accordance with prescribed methods. Projects of this type are no longer designed for a particular design storm but are designed to maximize the difference between the cost of the project and the benefits it creates. The goals of this project are clearly achievable at this time.

**4.06.90 USFWS Comment: Third,** the DEIS does note the three major alternatives, but does not provides a complete analysis of any actions other than constructing and maintaining the artificial berm and dune system. The consideration of relocating structures away from the shoreline fails to discuss a long-term, phased retreat and the advances in technology that make such relocations feasible. Project planning apparently only considered a single, short-term relocation of every current structure on the shoreline. This unrealistic approach was naturally deemed impractical. A more thorough analysis of a phased relocation program in combination with retrofitting existing homes to reduce damage and strict zoning standard must be undertaken as part of this project. CEQ's implementing regulations require, and numerous court cases have reiterated the need for, a "substantial treatment to each alternative considered in detail including the proposed action so that reviewers may evaluate their comparative merits (CFR 1502.14)." We believe the EIS and the Corps planning process have violated the spirit and intent of NEPA as well as the CEQ's implementing regulations.

**Corps Response:** See responses to comments 4.06.11 and 4.06.38.

**4.06.91 USFWS Comment: Fourth,** the tabular comparisons (DFR, Table 17; DEIS, Table 4-3) of the options seem strongly biased in favor of constructing the artificial berm and dune system. Impacts of this system to beach invertebrates and fish (larvae, juveniles, and adults) are all considered "temporary," (DEIS, Table 4-3) even though the same impacts would occur every few years for at least five decades and probably much longer. Since the resilience of many of the species at risk is unknown, the Corps should rethink whether these impacts recurring periodically over decades should be designated as "temporary." The Service also questions whether the replacement of oceanfront structures with a natural beach constitutes (DFR, p.

96) a "continued loss of aesthetic values." The tables also neglect the distinct possibility that constructing the artificial berm-dune system would reduce income and employment by reducing both commercial and recreational fisheries. The Corps should revise both tables comparing project alternatives. Both tables should also include a reference to the possible closure of the Oregon Inlet navigation channel.

**Corps Response:** As presented in section 6.12.2 of the FEIS, the Corps has agreed to monitor project impacts. Table 4-3 has been revised, cumulative impacts are discussed in revised Section 6.11.

**4.06.92 USFWS Comment: Fifth,** planning documents have not adequately addressed the risk that sand placed on project area beaches could be carried southward and close the Oregon Inlet navigation channel. Without a thorough analysis of both the direct and indirect impacts on the Oregon Inlet navigation channel that may occur with implementation of this project, the NEPA process is incomplete and unacceptable. The Corps should include Thompson and Gravens (1999) as an appendix in the Final EIS in the interest of full disclosure of the project's design and performance expectations to the public. The Final EIS should fully discuss the risk of channel closure and provide details on the social and economic impacts of such a closure and remedial actions that would be taken. The Corps should work with the Service and other interests, especially commercial fishermen, to ensure that an adequate plan is in place to minimize any disruptions associated with closure of the channel. This plan must be formalized with a Memorandum of Agreement among all interested parties to ensure that a crisis is not allowed to occur.

**Corps Response:** Disagree. The analysis of the possible impacts of the Dare County Beach project on Oregon Inlet have been adequately addressed. There is no chance that the Dare County project will have any significant impact on Oregon Inlet and most certainly never to the point of closing the inlet or the navigation channel.

**4.06.93 USFWS Comment: Sixth,** the selection of the preferred alternative failed to fully consider adverse environmental impacts. The DFR (p. 42) states that a shore protection project consisting of a beach berm or a berm and dune combination was selected as the "most appropriate measure" based on "**engineering and economic analyses**" [emphasis added]. There is no indication that environmental factors played a role. The Service requests, and NEPA implementing regulations require, that the Corps conduct another alternatives analysis that fully incorporates the environmental concerns given in these comments.

**Corps Response:** The purposes of Section IV of the feasibility report entitled "Environmental Considerations in Project Planning", were (1) to identify significant environmental resources which might be affected by a Federal project along the Primary Study Area; and (2) to identify criteria which should be followed in planning

and designing a project to minimize impacts on those resources. Environmental factors are considered on an equal basis with engineering and economic factors.

**4.06.94 USFWS Comment: Seventh,** the Corps did not fully commit to studies recommended by the Service for monitoring and documenting pre-project baseline conditions of aquatic resources and assessing project impacts. The project area is unique in many respects and dependence on short-term studies from other areas is not acceptable. The Service agrees with the Corps conclusion (DFR, p. 85) that "...some adverse environmental impacts are anticipated... on biological resources, water quality, aesthetic values and threatened species." Adverse impacts would also be produced on commercial and recreational fishing activity in the project area. However, the DFR and DEIS do not adequately analyze those impacts or propose adequate studies to document them. These deficiencies should be rectified in revised documents as noted elsewhere in these comments.

**Corps Response:** Revisions have been included in the FEIS in response to comments on this issue. We recognize that some uncertainty exists regarding the potential impacts and recovery rates that will be experienced in the project area, therefore we have agreed to monitor project effects as described in Section 6.12.2 of the FEIS.

**4.06.95 USFWS Comment: Finally,** the DFR (p. 3 1, 4 1) discusses federal action in a general sense as a "plan of improvement," but notes that such plans must be environmentally acceptable. It is unclear what improvements the current effort seeks. This statement raises the interesting questions of whether the barrier islands need "improvements" and whether any major alterations to the islands can be environmentally acceptable. Unimproved barrier islands have survived for centuries in one of the most geologic active environments in the world. These piles of sand have responded to a major rise in sea level and the force of massive hurricanes. In their natural state, the barrier islands of the Outer Banks are not conducive to large structures permanently fixed on a patch of sand. The islands have been hit by massive storms and the shoreline has been moving landward since European settlers arrived. People that build structures on the beach are either ignorant of the natural forces surrounding them or have chosen to ignore these facts. The frequent mention of a "natural" protective dune in the project area exemplifies the basic misunderstanding of the barrier islands by suggesting that nature has encouraged development by providing this dune which was, in fact, man made. The need for any "improvement" to the barrier islands is highly questionable. In fact, "improvements" aimed at preventing the barrier islands from moving to higher ground will ultimately lead to the destruction of habitat values and human amenities that barrier islands currently provide. The present need is not for improvement, but is instead a rescue effort. This is made all the more apparent when local and state governments are not willing to undertake such tasks unless there is some form of federal government subsidy.



We suggest the identified deficiencies in the documents be rectified, and a revised DFR and DEIS be issued for review before the Service can concur that the impacts of the proposed project have been fully identified and adequately avoided or minimized. Due to the significant adverse environmental impacts of the proposal, the flawed planning process, inadequate evaluation of direct and indirect effects and depending of the Corps' preferred alternative identified in subsequent draft and final environmental impact statements, the Department of the Interior may refer this project to the Council on Environmental Quality, pursuant to 40 CFR 1504.

**Corps Response:** Noted.

#### **National Park Service (NPS) Comments**

**4.06.96 NPS Comment:** The COE has asked that the National Park Service (NPS) issue a Special Use Permit (SUP) concurrently with these comments, for a portion of the project that is proposed on NPS property. However, the COE did not consult with the NPS on this proposed use of park lands in the early planning stages of this proposal. The NPS does not intend to issue the SUP permit for the proposed use of parklands described in the this document. This decision is based upon federal legislation and NPS policy that governs use of NPS lands. National Park Service Management Policies (1988) generally prohibit this type of use on National Park Service lands. We also question whether such use is necessary for the proposed project.

**Corps Response:** Noted.

The Department of the Interior was involved in the scoping process for the study and provided comments for our use. The National Park Service's policies and concerns about incompatible uses of the seashore were well known during the study process. In Section 8.03, it clearly states that in the event that the National Park Service could not issue a SUP, the project would be modified. Accordingly, it is now proposed to remove portions of the project that would encroach on Cape Hatteras National Seashore.

**4.06.97 NPS Comment:** We believe that the proposed project may have significant impacts on Cape Hatteras National Seashore (CAHA). We encourage the COE to use information provided in these comments to assist them in developing a more feasible and less economically and environmentally costly proposal for hurricane protection and beach erosion control in Dare County. As the FR/DEIS currently reads, the National Park Service believes the document to be inadequate to select the optimum alternative to accomplish project objectives. The National Park Service has concerns for the following:

- 1) the Purpose and Need for the Project;
- 2) National Environmental Policy Act compliance-,
- 3) Project Engineering;

- 4) the Economic Analysis;
- 5) Potential Conflicts with Coastal Zone Management Act; and
- 6) the Environmental Analysis.

The National Park Service believes the project description and justification are based on several unsupported assumptions and provide the basis for development of a project whose outcome is uncertain, considering the high economic and potential environmental costs associated with the project.

**Corps Response:** We appreciate the concerns of the National Park Service and share your desire to implement the most cost efficient and environmentally responsible project. However, we believe the information and analysis contained in the document, as revised, is sufficient to select the optimum alternative. Your concerns about our assumptions are addressed individually, below.

**4.06.98 NPS Comment:** One assumption that requires clarification is the continued reference to the term "natural dune" in the project area. The dune system that exists on the Outer Banks was initially constructed by the Civilian Conservation Corps in the 1930's. These dunes are artificial, not natural, and their existence is the primary reason that growth and development has occurred along the Outer Banks landward of the dune line, particularly in the last few decades. The eroding constructed dune the COE refers to is eroding as a function of naturally occurring coastal processes such as storms and sea level rise, processes that the COE will not be able to manage. The "protective" nature of this dune system, from its first construction, has always been limited. Only recently has the reliability of the dune's protective function been questioned, due primarily as a result of property damage resulting from storm-induced erosion events which have scoured the Outer Banks in recent years. This damage has not been the result of insufficient beach and "natural" dune protection, but rather the existence and continued development of areas affected by coastal processes within identified Ocean Hazard and Erodible Zones.

**Corps Response:** We do not believe we are laboring under any false assumptions about the dune field of the area. Perhaps it would have been more appropriate to use the term existing dune, regardless of its origin. We also are fully aware that these dunes are remnants of a large civil works project by the CCC and acknowledge that we will not be able to directly manage the natural forces that are attacking them today, principally storm induced erosion and sea level rise. Both of these forces are beyond our control, all we can do is plan a response to their actions. We concur that the protection afforded by this dune is limited.

**4.06.99 NPS Comment:** Many northeasters and tropical systems (hurricanes and tropical storms) have affected the Outer Banks and caused beach erosion and property damage. The DEIS provides this storm history and property damage information. According to global weather forecasters, the Atlantic and Gulf basins are in a period of increased storm frequency and intensity. It is likely that the Outer Banks will be subject to more frequent and intense storms, if predictions are

accurate. The National Park Service questions whether the COE has taken, into account this increased forecast storm frequency and intensity. These storm events can displace or remove large amounts of beach sediments from where they exist on the beach and perhaps negate any positive benefit projected to provide storm protection and reduce or prevent storm erosion. For example, at a COE sponsored Dredging Coordination meeting for the State of North Carolina in 1999, a COE engineer stated that the beaches of Nags Head lost about 1 million cubic yards of sand during Hurricane/Tropical Storm Dennis in September 1999. Hurricane/Tropical Storm Dennis was a small storm with minor winds that affected the coast for a week. Larger, more powerful storms could be expected to have as much or greater impact on the beach sediments. It is recognized that storm events can rapidly alter sediment budgets on the beaches. However, the FR/DEIS seems to disregard the evidence provided and claims to be able to provide adequate protection measures in the face of sea level rise, a history of storms in the region, and the likelihood of storms of increased frequency and intensity. Considering this information, the National Park Service questions whether the COE has established reasonable and realistic goals for this proposed project. The National Park Service requests that the COE provide an analysis of the project and projections of property damage and beach erosion, taking into consideration sea level rise and increased storm frequency and intensity. Ultimately, this consideration could lead to the development and/or recommendation of other goals and alternatives that are more likely to succeed.

**Corps Response:** The plan formulation process employed by the Corps follows specific Federal guidelines that require the development of a plan known as the National Economic Development Plan (NED Plan). The development of the NED Plan is accomplished by determining the level of storm damage reduction afforded by a particular plan cross-section when exposed to a whole suite of storms ranging from intensity of one that would be expected to occur every year (1-year storm) to one that may only occur every 500 years (500-year storm). Each plan is subjected to these storms in a series of life-cycle analysis (500 in this case) in which storm intensity and frequency is varied randomly over the 50 year planning period. The frequency and intensity of storms included in the analysis are based on the history of storms that have affected the area. Accordingly, this analysis includes cases in which the project is subjected to frequent and intense storms and cases in which very little storm activity occurs during the 50-year analysis period. The annualized cost of providing this plan is compared to the annualized storm damage reduction and other benefits to determine the plan's net benefits. Net benefits are simply the difference in the annual cost and annual benefits. The design cross-section that maximizes net benefits is the NED Plan. The cost of the NED Plan sets the upper limit of Federal cost for the project.

While there is some evidence that storm intensity may have increased, the current cycle is not unlike previous cycles that are present in the historic record. For example, storm intensity was high during the 1950's and 1960's. Accordingly, using historic storm data provides a realistic and unbiased representation of what storm

conditions may be in the future. Biasing the storm histories to represent a more severe period could have resulted in a project that was too large for the area needs.

**4.06.100 NPS Comment:** The National Park Service encourages the COE to consult with leading coastal geologists in North Carolina and incorporate their knowledge and experience into the process of developing feasible alternatives to meet project objectives. Dr. Robert Dolan (University of Virginia), Dr. Stan Riggs (East Carolina University) and Dr. Leonard Pietrafesa (North Carolina State University) can all provide valuable information to the COE for this project.

**Corps Response:** The Wilmington District has had ongoing relationships with Dr. Dolan and Dr. Riggs. Dr. Riggs was consulted with regard to potential offshore borrow area sources and Dr. Dolan has been provided all of the borrow and beach sediment data so that he could perform an independent analysis of the compatibility of the proposed borrow areas sediments. Dr. Dolan did provide a preliminary assessment of the borrow sand compatibility that identified some concerns. However, this preliminary assessment was based on an incomplete data set for the native sands in which only the nearshore samples were included. Once Dr. Dolan has had the opportunity to review all of the data, we believe he will agree with our conclusions.

**4.06.101 NPS Comment:** Another assumption used to justify this project and boost the economic analysis is that without the project, the beach will disappear, and without the beach, the tourism industry and local economy will suffer-due to losses of recreational use of the beach. The FR/DEIS provides no data to support that the beach will disappear without the project. The recreational use of the Outer Banks beaches seems to be increasing annually despite the rates of erosion and storms that have occurred on the Outer Banks. It is not reasonable to assume that the beaches, recreational beach use, and tourism will disappear without the project. Beaches will always be present on the coast and available for recreational activity. They may be narrower than historic beaches, but sea level rise and storm induced erosion affecting the constructed dune system create narrower beaches. Still, beach goes continue to stream to the Outer Banks. Conversely, with the project, the beaches in the project area will be much narrower than they are now (replacing the existing dune with a 50 foot wide berm reduces the beach area by 50 feet at all locations) and may restrict the number of recreationists that will use the beaches.

**Corps Response:** It is true that the beaches in the project area have not deteriorated to the point that tourists avoid the area. However, without some action, the beaches along the entire study area will eventually reach the condition we presently find along the South Nags Head portion of the area. This particular area is littered with failed protection attempts (sand bag revetments), piles from failed structures, and exposed septic tanks. The proposed project is intended to prevent this situation from developing along the entire study area. We recognize that there will always be a beach, our concern is preserving a useable beach. We believe that

beaches, like the one in South Nags Head, can be prevented so that the recreational experience of its visitors will be greatly enhanced.

**4.06.102 NPS Comment:** The FR/DEIS assumes that this beach will disappear. The FR then declares that the project will result in a benefit of \$427.1 million to Dare County by providing a recreational beach that would otherwise be lost, reduced property damage, and savings in emergency costs that would otherwise occur without the project. However, the National Park Service believes this is an unjustified assumption and that as long as there are beaches in these communities, there will always be people using them. Furthermore, the Economic Analysis for the Manteo (Shallowbag) Bay project states that growth of the area is increasing faster than the state average. Has the COE now reversed its position and believe that this growth will not occur because the beaches will disappear? This question must be answered and reasonable assumptions applied for this project and other COE related projects in the local area. The National Park Service believes that the COE should coordinate its projects and present an accurate and reasonable prediction of recreational use now and in the future in Dare County. The fact remains that no analysis has been made of recreational use in Dare County, future use of the beaches with or without the project, or consideration of other growth factors in the analysis of this project. The National Park Service requests that these analyses be conducted before claims of recreation loss due to loss of beaches can be made.

**Corps Response:** The economic analysis assumes that the area beaches will continue to be used at the same rate as present. The benefit claimed only includes an increase in the value of the recreational experience.

**4.06.103 NPS Comment:** The COE also assumes that barrier island dynamics can be "managed." The FR/DEIS assumes that the project will alleviate any change in shoreline position as a result of sea level rise and storm frequency and strength. The National Park Service believes this is an invalid assumption.

**Corps Response:** The Corps has demonstrated through its successful projects located at Wrightsville Beach and Carolina Beach that historic shoreline recession can be controlled and damages due to coastal storms greatly reduced. The planning for the project included consideration of historic shoreline changes in the area which implicitly includes changes in sea level that have occurred since 1940. Any increase in the rate of sea level rise would only affect the sea level rise component inherent in the historic shoreline change data. We calculate that sea level rise may be responsible for 1 to possibly 2 feet of erosion per year along the North Carolina coast. Since shoreline changes in the project area exceed this rate, other factors are obviously playing a dominant role. Should sea level rise accelerate, only the shoreline change associated with this factor would increase. In other words, if the rate of sea level rise doubled over the next 50 to 100 years, shoreline change rate would increase by 1 to 2 more feet per year than the current rate. These increases are not considered to be unmanageable.

**4.06.104 NPS Comment:** The underlying justification for project development seems to be the protection of existing structures and structures projected to be built in this area by the year 2004 (FR pages 7 and 30). However, this development could be managed in a manner that would reduce vulnerability to beach erosion and storm events by compliance with North Carolina Coastal Management Act provisions. Yet, it appears that the option to utilize proper coastal development planning is not considered. Rather the decision to implement an alternative that will likely encourage development in this ocean hazard area, expend large amounts of federal and local dollars to provide questionable storm protection and protection from beach erosion, and potentially create a situation that will result in greater storm damage and loss of life. The National Park Service does not believe this is a justified position to promote without further analysis. Furthermore, the National Park Service requests that the COE provide information on the potential for and increased impact of likely increased development in the project area if the project is implemented. The FR/DEIS should discuss in this analysis the additional potential for increased storm and erosion damage that will occur as a result of development associated with this project.

**Corps Response:** See response to USFWS comment 4.06.10 and USEPA comment 4.05.7. First, projects of this type are normally only recommended for areas that have essentially reached full development. Coastal development has accelerated around the State even though less than 9 miles of the State's shoreline is protected by a storm damage reduction project. This evidence along with that cited in response to USFWS comment 4.06.10 does not show a link between coastal development and beach nourishment projects. The State's coastal management program, with its rather stringent set-back requirements for ocean front structures, has helped to reduce the level of damages to some extent, but as the damages experienced during Hurricanes Bertha, Fran, Bonnie, Dennis, and Floyd have shown, set-backs alone are not the answer. Experience with existing projects during the recent hurricanes clearly demonstrated that beach nourishment is an effective means to reduce damage due to storms and long-term shoreline recession.

**4.06.105 NPS Comment:** The FR/DEIS claims that the development at Nags Head, Kill Devil Hills, and Kitty Hawk will continue to be threatened if no Federal action is taken. The fact remains that the existing development will always be threatened at this location with or without the project. This conclusion is misleading to the public and communities, implying that implementation of this project will result in the achievement of stated objectives.

**1) PURPOSE AND NEED:** The stated objective of this project in the FR/DEIS is to develop the most suitable plan to reduce hurricane and storm damage and reduce or prevent beach erosion in the project area. This objective seems an almost impossible task considering the coastal dynamics of the Outer Banks, increasing rates of sea level rise, and a history of prevalent storms in the region. This bold objective projects an attitude that the project will successfully tame the ocean, thwart sea level rise, and divert storms, hence reducing storm damage and beach erosion.

The COE admittedly states that "the development of major ports and terminals has been tempered by difficult currents, shoals, and shifting inlets that characterize this portion of North Carolina's coast. Indeed, these are among the most treacherous waters in the Atlantic" and "The Outer Banks is subject to the most severe wave climate along the entire East Coast of the United States." (DEIS 5-18 and DEIS 5-4 respectively). Furthermore, the COE recognizes in the FR that the proposed project will not eliminate beach erosion, especially during storms (DEIS, 4-7) and offers no method of protection against property damage that may result from storm-driven winds. In the event a major hurricane occurs on the Outer Banks, the COE analysis of property damage may be greatly underestimated and the proposed project objective will remain unmet. The COE must recognize that this plan may only provide protection for minor storm events. Hurricane Dennis, a Category I storm that never came closer than 90 miles to the Outer Banks caused tremendous property damage, beach erosion, and washed out a section of NC 12 north of Buxton, North Carolina. The National Park Service believes the COE has established goals that may be unachievable on the Outer Banks. The National Park Service encourages the COE to more fully consider alternatives that were not fully analyzed and additional alternatives such as building relocation, restricting developments according to North Carolina law, and avoiding unnecessary development in identified Ocean Hazard and Erodible Zones.

**Corps Response:** See response to comment 4.06.103. The restrictions imposed by the North Carolina coastal management program requires buildings to be set-back from the seaward line of stable natural vegetation by an amount equal to 30 times the long-term erosion rate for small structures and 60 times the long-term rate for larger structures. There are exceptions to these setbacks requirements that allow buildings to encroach into the setback zone. Given the variable nature of shoreline erosion, a building constructed today in full compliance with the setback could be in jeopardy in the future. The plan of protection recommended for the project area is not targeted for any particular storm but would provide substantial protection against a storm comparable to Hurricane Dennis and Hurricane Fran. The amount of damage would also be greatly reduced for a storm equal in intensity to the Ash Wednesday Storm of 1962. Given the fully developed nature of the area, building relocation is not an option and abandonment is not favored by the project sponsor.

**4.06.106 NPS Comment:** The wave climate, frequency of northeaster storms, tropical storms, and sea level rise all contribute to a dynamic coastal environment that becomes impossible to predict, much less "manage" as the COE suggests. These forces historically altered the coastline of North Carolina, and no effective engineering solutions have been developed to adequately mitigate the effects of these forces. The FR provides this evidence (FR, 24-29) by listing all the hurricanes and the associated damage that resulted. The FR provides further evidence of historical erosion rates in the proposed project area (FR 15-22).

**Corps Response:** Disagree. Again we point to the successful storm damage reduction projects at Wrightsville Beach and Carolina Beach which have afforded these communities considerable protection form over 35 years.

**4.06.107 NPS Comment:** The State of North Carolina has recognized the dynamic coastal environment in North Carolina and has passed legislation (CAMA 1974) to guide and manage development and other activities in North Carolina Areas of Environmental Concern (Ocean Hazard Areas, Ocean Erodible Areas, and Public Trust Lands), within which project lands fall. The CAMA sets forth policy that regulates setback requirements from the ocean, development restrictions, and encourages relocation of threatened structures in these areas.

**Corps Response:** North Carolina coastal management policies also recognize beach nourishment as an acceptable means of managing coastal erosion and preventing coastal storm damage. 15 N.C.A.C. Section 7M.0202(c).

**4.06.108 NPS Comment: 2) NEPA COMPLIANCE:** The National Park Service strongly believes that the COE has not complied with the intent of the National Environmental Policy Act (NEPA) in the development of this project. In the FR (page 24) the COE states that the "most effective solutions for the beach erosion problems along the Primary Study Area would be a beach berm project." This statement is made without full consideration of all alternatives and an objective analysis of all potential alternatives. The FR/DEIS does not present a full spectrum of alternatives and analysis that would justify selection of the optimum method to achieve project goals. Only two alternatives were considered, berm projects and berm and dune projects. This limited approach to the project is not adhering to the intent of NEPA.

For instance, the DEIS does not seriously consider the relocation of ocean front structures due to an estimated cost of \$300 million. However, based on projected costs of the selected plan, \$300 million is expended 24 years through the project life (\$49 million first three years for construction and \$251million over next 21 years for renourishment). Surely, the retreat from the ocean and the obvious loss of property damage during this time would result in a much greater savings to the public taxpayer and the federal budget, yet this alternative was not considered.

**Corps Response:** See responses to comments 4.06.11 and 4.06.38.

**4.06.109 NPS Comment:** The COE's requirement to select the National Economic Development (NED) Plan (alternative; FR8; DEIS 8-2) negates the entire process of NEPA and often results in the selection of an alternative that is not preferred and/or the most environmentally sensitive alternative. With this project, no environmental costs are considered in the selection of the alternative that provides the highest NED benefit. Similarly, the dune and berm configuration that could provide the most protection is not selected because it does not convert to the highest NED benefit. Therefore, the intent of NEPA and the objectives of the project are minor considerations in the selection of a suitable alternative. The National Park Service



believes the alternative selection process used by the COE does not provide adequate consideration and valuation of environmental costs likely to occur as a result of selection of the NED plan.

**Corps Response:** We disagree. Within the overall planning process, which includes the development of appropriate environmental documents, the NED plan is evaluated and compared with other alternatives, including a without project alternative, and alternatives outside the agency's jurisdiction. All reasonable alternatives are identified in the Corps planning process, and all environmental impacts are considered when formulating and evaluating these alternatives in the NED selection process.

**4.06.110 NPS Comment: 3) PROJECT ENGINEERING:** The National Park Service believes the FR/DEIS does not present full consideration of the dynamic coastal processes on the Outer Banks, likely storm scenarios, and rising sea level in the development of the full range of feasible alternatives to achieve project objectives. The FR/DEIS does present and frequently refers to these processes but does not seem to consider and analyze these processes for the project.

The COE again chooses to use the GENESIS model for the basis of engineering the solution to achievement of the project objectives. However, as previously recorded in comments on the Manteo (Shallowbag) Bay project (March 1999), the National Park Service and other prominent coastal geologists do not agree that GENESIS is a model that provides accurate and realistic modeling of the coastal dynamics that occur in the proposed study area. Because the proposed project engineering is based upon this model, the National Park Service believes that the engineering solution selected to meet the project objectives does not represent a feasible and realistic method to obtain project objectives.

The COE uses another model GRANDUC, a model with which the National Park Service is unfamiliar. The assumptions used to justify this model for its use for this project should be provided in the final EIS.

**Corps Response:** See response to USFWS comments 4.06.50 to 4.06.53. The models used to formulate the Dare County Beaches project are accepted engineering tools that provide a means to develop relative comparisons between alternatives. There has never been any contention on the part of the Corps that the models religiously duplicate the natural system. With respect to GRANDUC, the program has undergone and continues to undergo scrutiny throughout the various technical organizations within the Corps. The model has been accepted as being the best risk and uncertainty model available today to evaluate coastal storm damage reduction projects, but just like most models, work to improve the performance of the model will continue. The final EIS and feasibility report include a comprehensive description of the program.

**4.06.111 NPS Comment: 4) ECONOMIC ANALYSIS:** The National Park Service believes the FR/DEIS presents an overestimation of benefits for this proposed plan and an underestimation of the costs of implementation. The fact that the COE is forced to select the NED plan immediately disregards any environmental damages or mitigation costs associated with the project. These costs, which do exist, have not been factored into the Economic Analysis.

### **Benefits**

The stated annual benefits of savings derived from reduced hurricane and storm damage should be reduced by an amount equal to the damage that will occur when the project is implemented and severe storms occur in the area. This listed figure is not realistic because some damage will always occur from storms that pass through the project area. Additionally, the analysis should include estimates from hurricane and storm wind damages, which the project does not and can not prevent.

The National Park Service also believes that the Emergency cost savings as a result of the project are over estimated. It does not seem possible that the costs associated with beach scraping and pushing, sandbagging, North Carolina Department of Transportation emergency costs, damage to public property, and damage to private property, cleanup costs, post-storm recovery expenses, etc., will be precluded by this project as claimed (FF, 33). The National Park Service requests that reasonable estimates of these costs for the project be provided.

It is unclear how the COE calculated a "with project" unit day value of \$5.17 per person, an increase of \$1.30 per person from the "without project" unit day value. This figure seems to be based solely on the assumption that the recreational experience with a berm and dune condition will be more valuable than the current value. However, the COE does not provide any information that supports this increase in value. The National Park Service requests that the FR/DEIS provide the data or information to support the increased value in recreation with the project.

### **Costs**

The analysis does not include the loss of benefit that occurs when portions of the berm and dune are lost to storms or other coastal process related erosion. When the berm and dune are eroded and before replenishment occurs again, there is a theoretical loss of "protection" by the berm and dune. This figure must be subtracted from the benefit of property loss prevention.

Furthermore, the dollar value loss of the berm and dune and repairs to this berm and dune must be calculated into the analysis.

The costs of future damage from increased development in the project area should also be included in the cost analysis.

The National Park Service believes that, the costs of the project are underestimated and requests the COE to conduct a more comprehensive and realistic cost analysis for the project.

**Corps Response:** The Corps disagrees with the comment's appraisal of the costs and benefits. All of the things mentioned in the comment have undergone a great deal of technical and policy scrutiny within the Corps. As for residual damages with the project in place, they can be found in section 4.10, Appendix H, and in the "Plan Accomplishments" section of the main report. The analysis obviously makes no assessment of wind damage and claims no benefit for its reduction. The sources for the information regarding emergency cost reductions include FEMA, CAMA, NCDOT, private equipment operators, business owners, and town and county officials. The fact that these activities are nearly non-existent with a project in place can be verified with our experience with existing nourished beaches in North Carolina. As for the recreation analysis, it is explained in Appendix H that the increase of \$1.30 per person per daily visit stems primarily from the willingness to pay for a nicer beach experience. More precisely, it is derived from survey responses based on the point table H-16, Appendix H. The comment's assessment that it "seems to be based solely on the assumption that the recreational experience with a berm and dune condition will be more valuable than the current value" is basically correct. That is to say the difference is based primarily on the user's willingness to pay to visit a wide and stable beach with no sandbags and damaged structures. The economic theory behind the \$1.30 increase in willingness to pay is well-founded in recreation literature and is in-line with other beach studies throughout the country. It yields about 12 percent of the project benefits and the project would still be justified if there were no recreation benefits.

The cost related part of the comment has been addressed in another response. See response to USFWS comment 4.06.52. The GRANDUC model allows the width of the plan cross-section to vary during the life cycle simulation in response to the number and frequency of storms. Accordingly, there may be times in the analysis in which something less than the full project cross-section is available. The reduced cross-section at the time of a particular storm event is reflected in the storm damages determined for that particular event. The amount of material eroded from the project profile by the storm is added to the subsequent nourishment requirement. The project cost estimate also includes costs associated with non-Federal maintenance of the dune such as bulldozing to restore the dune, dune fertilization, re-grassing, etc. As for the notion of increased development from the project, we are not aware of any relationship between damage to the dune and berm project and future development. See response to comment 4.06.10.

**4.06.112 NPS Comment: 5) CONFLICTS WITH NORTH CAROLINA COASTAL ZONE MANAGEMENT ACT.** The National Park Service believes that this project has potential to be in direct conflict with the Coastal Zone Management Act (1972) and the North Carolina Coastal Area Management Act (1974) (CAMA). As a federal agency, the National Park Service must comply with the Coastal Zone Management

Act and the North Carolina CAMA. Implementation of the proposed project would be in conflict with this requirement and potentially violate several provisions of CAMA that pertain to use standards in Areas of Environmental Concern (AEC) in North Carolina. The entire proposed project area lies within an AEC, namely the Public Trust Lands, Ocean Hazard Areas, and Ocean Erodible Zone. Provisions of these CAMA sections do not permit the activities proposed for this project unless there is sufficient mitigation or a variance is granted for this project. Yet, no such mitigation for the project, other than for sea turtle monitoring, is offered.

**Corps Response:** We believe that the consistency compliance with our determination is best left to the NC Division of Coastal Management. We have been coordinating with that agency throughout the development of the proposed project. Our Consistency Determination is included in the FEIS, Section 7.02.

**4.06.113 NPS Comment: 6) ENVIRONMENTAL ANALYSIS:** The National Park Service believes that the environmental analysis provided by this project does not fully disclose and address the impacts this project may have on federal, state, private, and municipal resources. Several times the FR/DEIS stated that the project is environmentally acceptable, yet the document also states there will be adverse impacts to several environmental parameters. Based on information provided in the DEIS, the National Park Service does not believe that the COE can claim that adverse impacts are environmentally acceptable. The DEIS is not the document to make that declaration. It is the understanding of the National Park Service that this decision can be rendered only after all direct, indirect, and cumulative impacts of the project have been identified and evaluated. The claim that the project is environmentally acceptable is premature; the purpose of the DEIS is to provide a forum for agency, organizational, and public review so that the additional environmental concerns and impacts can be identified and incorporated into the process.

**Corps Response:** Full disclosure of all environmental impacts is desirable but difficult because of the inherent uncertainty surrounding any action. NEPA documents typically present an agency's preferred alternative and agencies usually only recommend alternatives they believe to be environmentally acceptable. Based on prior experience in other areas and our knowledge of the resources in this project area, we believe that the project, as proposed, is environmentally acceptable and likewise believe that it is important to tell reviewers our position. This does not mean that our views cannot change if the weight of information disclosed by additional study or public review indicates that the degree of impact is unacceptable.

**4.06.114 NPS Comment:** The FR/DEIS claims that impacts from the project will be reduced by the use of beach compatible material. However, comments provided by Dr. Robert Dolan and data in the DEIS suggest the material from the borrow areas is not compatible with materials on the beaches. If this material is used, it appears likely that the sand will be transported off the beach during tidal cycles and storm events and its value and purpose will be greatly diminished or potentially lost.

According to Dr. Dolan, "The obvious conclusion is that a substantial percentage of the material that would be extracted from the identified source areas offshore would be finer in grain size than the native beaches, and thus suggest that the hydraulics of the beaches in the project area would be too energetic for the finer fraction to have a very long residence time in the project area," (DEIS Appendix Q. The National Park Service does not believe that a suitable sand source that will be compatible with the native beach sands has been identified and located. The National Park Service further believes that a substantial portion of the material deemed suitable for the project could move south into CAHA. No impact analysis of this probability has been conducted. The National Park Service requests that a thorough analysis of the impacts that sediments of this size will have on water quality, benthic organisms, intertidal organisms, and dredging in Oregon Inlet (see Cumulative Impacts below) be provided.

**Corps Response:** A Sand Compatibility Analysis (Native Beach Sand Versus Borrow Sand) has been conducted. This analysis included samples of native beach and the potential borrow areas. The search for suitable borrow material for construction and periodic nourishment was conducted in two phases. Phase I consisted of the collection of over 535 miles of seismic subbottom profiles. Phase II involved the collection of 208 vibracore samples. Grain size analyses were conducted on sediment samples collected from the vibracores and were used to delineate potential borrow areas. The grain size characteristics of the sediments were used to develop weighted composite grain size distribution representative of all of the sediment in each borrow area. The weighting was based on the grain size distribution and thickness of a particular sample. A weighted grain size distribution was computed for the entire core. The weighted core distributions were used to compute the overall composite characteristics for the entire borrow areas. The analysis included an estimate of the amount of fine-grained sediments in each core.

As part of the process to determine borrow sites, additional borings will be drilled in the previously identified borrow areas prior to the beginning of the nourishment project. If these borings show material that is not suitable for use as beach fill, then they can be eliminated for use as borrow at that time. All material, which is not suitable for beach fill, will be avoided. There is no guarantee when performing a subsurface investigation that all material between borings will be consistent due to the spacing of the borings. If during dredging, areas are identified that have too much material unsuitable for beach fill, they can be skipped over by the dredging operation. Previous contract specifications have addressed this, and there are directions to the contractor on how to proceed when this occurs.

When material is removed from a borrow area and placed on a receiving beach, the deposited sediment will be sorted by wave action. If the beach fill material contains all of the same grain sizes that exist on the native beach, the beach fill will be redistributed by waves and currents to an quasi-equilibrium position of the beach profile. The coarser grained material will remain on the foreshore while the finer fractions will move to the deeper portions of the profile.

One estimate of the suitability of borrow material for placement on the beach is based on the overfill factor. The overfill factor is an indication of the volume of borrow material required to produce one net cubic yard of sorted beach fill material. The overfill factor is computed by numerically comparing the size distribution characteristics of the native beach sand with that in the borrow area and includes an adjustment for the percentage of fines in the borrow area. The overfill factor is based primarily on the assumption that the borrow material will undergo sorting and winnowing once exposed to waves and currents in the littoral zone resulting in a sorted distribution approaching that of the native sand. The numerical procedure for computing an overfill factor is contained in a suite of computer programs contained in the Automated Coastal Engineering System (ACES) produced by the U.S. Army Coastal Engineering Research Center.

The overfill factor for borrow area N1 is 1.5. This overfill factor is influenced by the difference in the composite mean grain sizes of the borrow material (N1 is 0.22 mm) versus the native beach material (north project beach is 0.31 mm). The mean grain size for the north project beach is 0.31 mm.

**4.06.115 NPS Comment:** Additionally, the National Park Service is concerned that excavation of the borrow areas will significantly alter the biological base of these borrow areas and potentially affect a wide range of ecological parameters in the area. The FR/DEIS claims that no adverse impact will occur but does not provide the data to support that statement. The National Park Service requests that the data be provided that supports the claims that this project is environmentally acceptable and that impacts will be minimal to benthic and fishery resources in the offshore borrow areas.

**Corps Response:** Our analysis of available data concerning offshore resources of the project area and the impacts of offshore borrow sites in other locations did not provide any reason to believe that the proposed sites were exceptional or that the impacts of using these areas would lead to unacceptable impacts. We have expanded our analysis of this issue in Section 6.11. Regardless, in recognition of the uncertainty surrounding this issue, we have agree to monitor the impacts of the project on the environment.

**4.06.116 NPS Comment:** The National Park Service also requests that the data be provided that suggests that the effects of excavation of the borrow sites will have minimal effect on the local wave climate, potential erosion, and sediment budgets in the project area. Since a portion of CAHA is directly adjacent to the southernmost borrow area, any impacts as a result of excavation could potentially affect CAHA. These impacts must be clearly understood before a project of this magnitude can proceed.

The FR/DEIS states that a 3,000 foot transition zone for the project is planned for CAHA and that CAHA can expect beach fill to be transported as far as 6,000 feet

below this transition zone, potentially affecting 9000 feet or 1.7 miles of CAHA beach and shoreline. Since CAHA does not intend to issue a SUP for this transition zone, there is still recognition that at least 6000 feet of shoreline and beach will be affected. The COE does not describe or analyze the effects this project will have on CAHA resources, other than to say there is a benefit from increased recreational use of the Seashore. First, there is no evidence that recreational use of the Seashore will increase as a result of this-project. Second, increased usage also increases impacts from recreational use. The FR/DEIS must fully describe the direct, indirect, and cumulative impacts of this project for the duration of the project on CAHA resources (natural, cultural, and recreational) and operations.

**Corps Response:** The project has been modified to eliminate the 3,000 foot transition fill on the Cape Hatteras National Seashore (CHNS) lands that was originally proposed for the south end of the south project. As indicated in the FEIS and Final Report, the most southern end of the transition will terminate north of the CHNS lands. Our shoreline response modeling still indicates, however, that material placed within the project boundaries and north of the Cape Hatteras Seashore northern boundary will spread southward and will still extend 9,000 feet into the Seashore.

**4.06.117 NPS Comment:** The recognition that the beach fill material will move southward at least 6000 feet from the transition zone also recognizes the fact that substantial amount of beach fill could be transported south into Oregon Inlet, a possibility which is essentially ignored. The FRJDEIS claims that the amount of sand that could be transported and have to be dredged out of Oregon Inlet due to project conditions falls well within the annual variation of current dredging operations. As mentioned earlier, a COE employee has stated that over 1 million cubic yards of beach sediment were transported off Nags Head beaches in September 1999 during Hurricane Dennis. The COE employee also said that 600,000 cubic yards of this material ended up in Oregon Inlet. Should this be an accurate statement, then the analysis provided in the section on Maintenance of Oregon Inlet needs to be revised to reflect a more likely scenario and include any provision or contingencies the COE plans in the event that material outside the annual variation is transported into Oregon Inlet. These costs must be accounted for in the economic analysis.

**Corps Response:** See responses to comments 4.06.51, 4.06.52 & 4.06.82. The COE made no estimates of the material lost off of Nags Head or other Dare County beaches north of Oregon Inlet following Hurricane Dennis so we are not aware of the source of the million cubic yard erosion estimate for Nags Head. Following Hurricane Dennis, surveys of Oregon Inlet showed that the ocean bar channel had shifted to the south and reestablishment of the authorized channel dimensions (400 feet wide at a depth of 14 feet deep at mean low water) would require the removal of approximately 600,000 cubic yards. However, by moving the channel markers and realigning the channel to the naturally deep water, less than 300,000 cubic yards of maintenance dredging was required to reestablish the channel. The southward migration of the Oregon Inlet ocean bar channel has been a maintenance problem

for at least the last 10 to 15 years and is associated with the encroachment of the Bodie Island spit, both the sub-aerial and sub-aqueous portions of the spit, into the inlet. This southward migration has persisted over the years in the absence of severe storms and is simply a characteristic of the inlet that adds to the difficulty of maintaining the channel. Therefore, the situation that existed in Oregon Inlet following Hurricane Dennis was not unusual and there is no evidence that Hurricane Dennis exacerbated the situation.

**4.06.118 NPS Comment:** In Table 4-3 (DEIS) a list of comparative impacts of the project is provided. Many of these impacts are not supported by data and can be considered only speculative. The National Park Service requests that the data be provided that supports the claims made in this table. The following claims need support:

Under the NED Plan, additional information is needed to support the claims that:

Improved recreational quality will be a benefit,  
Improved appearance of the beach will enhance the recreational experience,  
Only a temporary loss of benthic invertebrates will be experienced in the borrow areas,  
Only a temporary loss of beach invertebrates will be experienced.

The COE is requested to analyze and discuss the impacts that increased recreation will have on the project area and local interests that will be affected, such as CAHA.

**Corps Response:** See response to comment 8.01.39.

The benefit for enhanced recreation experience is well founded in recreation economic literature. The procedure used in this feasibility study is consistent with Federal guidelines and has passed both technical and policy review within the Corps. The analysis does not claim any increase in visitation.

**4.06.119 NPS Comment:** The National Park Service strongly disagrees with the claim that beach invertebrates will only experience a temporary, localized, and reversible loss. Based on the proposed construction and periodic nourishment schedule, there will be little time for beach invertebrates to recover, potentially impacting a significant ecological community on the Outer Banks. The FR/DEIS did not refer to Dr. Cinde Donoghue's 1999 work on beach invertebrates on Pea Island National Wildlife Refuge and Cape Hatteras National Seashore, research that the National Park Service has deemed critical to understanding intertidal ecology. Donoghue's research has indicated that projects of the nature proposed by this project can eliminate beach invertebrates for years. Should the project area be continually renourished as proposed, beach invertebrates could be totally eliminated. The National Park Service views this as an unacceptable impact and requests that this information be incorporated into the impact assessment of the proposed project.



**Corps Response:** We have reviewed Donoghue's work and did not reach the same conclusion as the NPS. While Donoghue 1999 work did state "If a nourishment takes place in early October, soon after the final *Emerita* larval recruitment has occurred, it will eliminate the new recruits and overwintering females", it went on to state "The area will not be repopulated until late the following summer", clearly indicating that repopulation of the effected area from outside sources can be expected to occur. Moreover, in discussing the depression in population numbers following disposal, she stated "Evidence suggests that the organisms are not being killed or buried." If these organisms are not being lost, then they are still available within the larger system and will likely contribute to repopulation. We concur with the NPS that our repeated nourishment of the beach may keep populations of beach invertebrates in a state of recovery; however, we do not believe that total elimination of all beach invertebrates is a likely scenario. See response to comment 8.01.39

**4.06.120 NPS Comment:** The National Park Service also requests that the COE discuss the cumulative impacts this project will have on statewide or regional resources. Numerous other dredge and fill projects not discussed by the COE in their analysis of cumulative impacts are planned for North Carolina, including impacts from previous beach disposal operations. NEPA requires that all of these projects be considered in the cumulative impact analysis and this project is no exception. The FR/DEIS only provides information on the total amount of North Carolina beaches "impacted" by dredging operations in their cumulative impact analysis. However, they do not discuss true "impacts" of each of these projects and the cumulative effect these impacts have throughout the region. The FR/DEIS does not provide a comprehensive analysis of the impact of this project on the effectiveness of the dual jetty system and sand bypass system at Oregon Inlet. The National Park Service requests these analyses be provided.

**Corps Response:** See response to USFWS comments 4.06.51, 4.06.52, and 4.06.82. The potential changes in sediment transport rates that would result from the Dare County Beaches project are relatively small and would not reach its full potential until year 50 of the project life. Accordingly, the beach project would not have any impact on the dual jetties proposed for Oregon Inlet or the associated sand management plan. The cumulative impacts analysis for the project has been revised in response to comments on the DEIS. Please see the expanded discussion of cumulative effects in Section 6.11.

**4.06.121 NPS Comment:** The FR/DEIS states clearly that "No compensatory mitigation is proposed for this project" (DEIS 6-23) and the only other mitigation proposed is to monitor sea turtle nesting during the nesting season because of the desire by the COE to construct this project during the nesting season. The National Park Service requests that mitigation monitoring funds be identified in the project that will permit the comprehensive assessment and monitoring of impacts to nearshore organisms, intertidal organisms, and shorebirds utilizing these resources, before, during, and after project implementation.

**Corps Response:** See response to comment 4.02.2 above.

**4.06.122 NPS Comment: CONCLUSION** - The National Park Service believes the time permitted for adequate review and comment on this project was insufficient. This three volume document contained a tremendous amount of information that could not be adequately reviewed in the time frame given to arrive at a full understanding of the implications and impacts this project may have on the Outer Banks coastal environment. The National Park Service believes that time constraints imposed by the COE for reviewing and providing comment on this project has resulted in an incomplete comment of this document by the National Park Service and perhaps others.

**Corps Response:** Council on Environmental Quality (CEQ) regulations provide for a minimum of 45 days for review of a Draft Environmental Impact Statement. 40 CFR Section 1506.10(c). The comment period on this DEIS was 45 days. While the Corps did not formally extend the comment period, this and other commentors were told that comments received within two weeks of the end of the comment period would be considered. The comment letter from the Department of Interior, including letters from the U.S. Fish and Wildlife Service, the National Park Service, and the U.S. Geological Survey, were received on September 15, 2000. These comments have been fully considered.

The Corps published a Notice of Intent for this DEIS in the Federal Register on July 23, 1997. In addition, the Corps circulated a scoping letter to local, State and Federal agencies, as well as members of the public, in July of 1997. The Department of Interior (USFWS), Department of Commerce (NMFS), the State of North Carolina (Division of Water Quality, Division of Environmental Management, Department of Transportation and Wildlife Resources Commission) responded to that Notice and scoping letter, as did five private individuals.

Corps regulations provide that requests to expand the review and comment period for an EIS will be based on timeliness of distribution of the document, prior agency involvement on the proposed action, and the action's scope and complexity. The DEIS was widely and quickly distributed. Requests for copies of the document were honored as quickly as possible. The Corps provided opportunities through the scoping process for public input into this project. Scoping comments from individuals and State and Federal agencies were received and addressed in the DEIS. Finally, this proposed action is neither unusual nor particularly complex. The Corps has implemented similar projects, albeit smaller in size, in other parts of the State. The Corps believes that the issues related to these projects are familiar to parties interested in this proposed action.

On balance, the Corps believes that there has been ample public input into this proposed action, and that the interested agencies, organizations, and general public have had a sufficient period to review and comment on the DEIS.

**4.06.123 NPS Comment:** The National Park Service believes the COE has established goals that may not be achievable on the Outer Banks. The National Park Service encourages the COE to more fully consider alternatives that were not fully analyzed and additional alternatives such as building relocation, restricting developments according to North Carolina law, and avoiding unnecessary development in identified Ocean Hazard and Erodible Zones. The COE has relied on engineering solutions for this project rather than explore other feasible alternatives that may be accomplished by other agencies or partnerships.

**Corps Response:** See response to comment 4.06.11.

**4.06.124 NPS Comment:** The economic analysis seems to be based on assumptions not justified in the FR/DEIS and represents an unrealistic projected future condition. For instance the FR/DEIS does not analyze recreational use of beaches in the Project Area. The National Park Service believes that tourism and recreational beach use will continue without the project, since the beach will always be present. Furthermore, the project will not preclude all damage as the FR/DEIS suggests. As a result, the benefit/cost ratio of this project is believed to be exaggerated.

**Corps Response:** The Corps disagrees that the benefit/cost ratio is exaggerated. It has undergone a great deal of technical and policy scrutiny within the Corps. Again, the analysis does not claim any increase or decrease in visitation under either the with or without project conditions.

**4.06.125 NPS Comment:** The environmental analysis does not fully analyze the direct, indirect, and cumulative impacts of the proposed project and related regional projects. Therefore, a thorough evaluation of the impacts was not made, and the selection of an alternative to accomplish project objectives is premature.

**Corps Response:** Our analysis of available data concerning offshore resources of the project area and the impacts of offshore borrow sites in other locations did not provide any reason to believe that the proposed sites were exceptional or that the impacts of using these areas would lead to unacceptable impacts. We have expanded our analysis of this issue in Section 6.11 of the FEIS. Regardless, in recognition of the uncertainty surrounding this issue, we have agreed to monitor the impacts of the project on the environment as described in Section 6.12.2 of the FEIS.

**4.06.126 NPS Comment:** The National Park Service supports the project objective of reducing storm damages to existing properties on the Outer Banks. However, we do not believe there is economic practicality or environmental sensitivity in attempting to reduce beach erosion and property damage from storm conditions prevalent in the area by the method proposed.

**Corps Response:** While we appreciate NPS support of the objective of reducing storm damages to existing properties, we disagree that the proposed project lacks practicality or environmental sensitivity. There are many other traditional methods that could have been used to address the problems of the area, such as groin fields and seawalls, that were not even considered as a part of the study because we considered them to be environmentally unacceptable at this location. Most agencies consider beach nourishment projects to be far more environmentally sensitive than hard structure solutions and we concur with that position. Even though the costs of beach nourishment are high at this location, our analysis shows that it is still economically feasible.

**4.06.127 USGS Comment:** Careful and detailed examination of the economic calculations of project costs and projected future benefits are extremely important in judging the Dare County project. Because there is some concern about the accuracy of the nourishment/erosion model, provisions need to be made for a thorough review of the economic calculations that contribute to the cost/benefit ratios.

**Corps Response:** There are no projected future benefits in the analysis. The benefit-to-cost ratio is based on the existing level of development. All of the things mentioned in the comment have undergone a great deal of technical and policy scrutiny within the Corps.

#### **U.S. Geological Survey Comments**

##### **4.06.128 USGS Comment: DRAFT FEASIBILITY REPORT**

Page 87, Volume 1, Section VI - SELECTED PLAN OF IMPROVEMENT, ENVIRONMENTAL IMPACTS, ENDANGERED AND THREATENED SPECIES:

The report indicates that both pipeline and hopper dredges will be used for project **(Figure 9, Periodic Nourishment)**, yet states that hopper dredges will be used for nourishment of the North Project Area where sea turtles occur. Hopper dredges are particularly harmful to sea turtles. Pipeline dredges are considered less harmful to sea turtles. Because the proposed project has a 50-year project life **(Table 4-3: Comparative Impacts of the Proposed Plan to the Nonstructural and No Action Alternative)**, the Corps of Engineers (Corps) should reconsider the use of pipeline dredges for the North Project Area to favor sea turtles, many of which are endangered and threatened.

**Corps Response:** Page 87 of the report was in error when it stated that hopper dredges will be used for nourishment of the North Project Area. The type of equipment used for initial construction would be selected by the contractor. As stated in the DEIS, the type of dredge used will depend on many factors including competition in the market place, pumping or haul distance, depth and extent of dredging, weather conditions, and time of year. The "Outer Banks" of North Carolina is subjected to the most severe wave climate along the entire East Coast of the

United States and some pipeline dredge contractors may not bid this work because of potential hazards to crew and equipment. Hopper dredges are much more mobile than pipeline dredges and can exit and return to a work site in spite of bad weather with much greater ease and at far less expense. Because of the potentially hazardous work conditions, restricting the work only to pipeline dredge contractors is not feasible. The Corps is aware that hopper dredges can be harmful to sea turtles and over the past 10 years has spent over \$3 million to research ways to reduce sea turtle takes. In order to minimize impacts to sea turtles, new technology and techniques developed by the Corps to reduce sea turtle takes will be required of any hopper dredge contractor performing construction or maintenance work on the project.

**4.06.129 USGS Comment: Page 101, Section VII - CONCLUSIONS AND RECOMMENDATIONS, RECOMMENDATIONS:**

In item "e", in addition to public education and outreach for flood plain information, coastal erosion and rising sea-level information needs to be included to discourage unwise and unsustainable coastal development. The planners and managers and the public should be made aware that erosion and flooding risks are likely to increase along the North Carolina coast in the near future and that beach nourishment is a costly and nonpermanent means of mitigating erosion.

**Corps Response:** Beach nourishment has been demonstrated to be an effective and cost efficient means to reduce the hazards to coastal development posed by continue shoreline recession and the damage caused by coastal storms. However, development along the coast is expanding even in the absence of beach protection projects. The proposed coastal storm damage reduction project would simply reduce the amount of damage these areas will experience in the future and lessen the public sector financial burden to repair these storm damages.

**4.06.130 USGS Comment:** In item "i", it should be clearly stated that the non-Federal partners are obligated to pay their share of the periodic nourishment costs for the 50-year project life. All of the benefits of this project are formulated on a 50-year life and the State and local governments need to be fully aware of their considerable financial commitment in moving ahead with the Dare County project.

**Corps Response:** The non-Federal sponsor (Dare County) is fully aware of their financial commitment as expressed in their letter of intent to sponsor and provide the non-Federal share of project costs. Their financial plan, which is part of the Project Cooperation Agreement package, identifies the financial resources that they will utilize to pay for their share of the project for the 50-year project life. Execution of the PCA will be the contractual agreement between Dare County and the Federal Government to construct and maintain the project for 50 years.

**4.06.131 USGS Comment: Volume II, Appendix D, Coastal Engineering**

#### **Page D-9, Section 4. Data Collection, 1) Seismic Surveys:**

For the data-collection period of July-August 1994, where 535 miles of data were collected along 480 miles of track lines, the grid-line spacing needs to be defined. In addition, although this information is useful in regards to helping to define subsurface stratigraphy, there are gaps in the data between grid lines. Side-scan sonar, used in conjunction with shallow sub-bottom profiler data, is useful in helping to refine shallow stratigraphic mapping, and identifying habitat areas and live hard bottom areas. However, there are no maps showing the results of these surveys. Without these data (side scan sonar and shallow sub-bottom profiler data) collected multiple times, it is unclear how quantitative predictions regarding sand migration can be produced, and how the effects of beach nourishment methods on various nearshore habitats and ecosystems can be made.

**Corps Response:** This section briefly summarizes the geophysical survey effort detailed in the Geotechnical Appendix. The primary purpose of this work was to define the shallow stratigraphy in the search for sand deposits for beachfill. Digital side-scan sonar data was collected concurrently with the sub-bottom data. Detailed side-scan sonar surveys with parallel lines spaced at 100-foot intervals were also performed in the proposed borrow areas as part of the Cultural Resource Survey, Attachment B.

#### **4.06.132 USGS Comment: Page D-10, Section 5. Final Borrow Site Selection:**

The recommended plan calls for dredging over 66 million cubic yards of sand (page 4-3 of the Draft EIS) from two offshore borrow areas that are within three miles of the shore, close to the project beaches, and seaward (-30 to -50 ft) of the calculated "close-out depth" for this part of the North Carolina coast. Using the vibracore logs and grain-size data, the S- 1 area appears suitable based on mean grain size, sorting, and minimal fine-grained sediments, but the N-1 area contains sand considerably finer than the native beach sand. With an overfill ratio of 1.5, this sand fill is likely to erode even faster than parts of the nourished beach with coarser, more suitable sand. As such, post fill erosion rates could be significantly higher than modeled in the Draft EIS, requiring more frequent periodic renourishment than planned. This will increase the project costs, change the shore-property damage projections, and reduce the project benefits. In turn, it will likely shorten the time when the Corps, the State, and local government officials must once again expend considerable public monies temporarily protecting property and development from storm erosion and sea-level rise.

Borrow sands should be analyzed for their chemical composition in order to match the island sand. Color and heat content of sand are factors to consider. A sand with high-quartz content has a heat capacity of about 44.59 J/mol (k) while the heat capacity of a calcite sand is about 83.47 J/mol (k). Therefore, high-quartz sands are hotter than those sands with a high content of calcite. If sands with significantly

different heat capacities are used as replacement sand, this could have a deleterious effect on animals that live in the swash zone.

**Corps Response:** See response to comment 4.06.48 and 4.06.67. The material in the proposed borrow areas is predominately quartz sand with shell contents comparable to the native sands. The chemical make up of the borrow material would not have an impact on material temperatures in the swash zone as temperatures in this area would be controlled by water temperatures. Previous experience shows that soils bleach out to a natural beach color approximately six weeks after placement.

**4.06.133 USGS Comment: Page D-23, Section c. Long-Term Erosion Rates:**

Future shoreline positions are based solely on extrapolation of historic rates of erosion, but this is likely to be too conservative because of increasingly credible scientific information and predictions that sea-level rise will double over the next century, and that with climate change, the frequency and magnitude of coastal storms will increase. Both of these factors exert strong control on coastal processes, and a rise in sea level and an increase in storminess will result in even more erosion for coastal North Carolina. Such information needs to be factored into management planning and the Draft EIS.

**Corps Response:** Corps policy is to only consider the impacts that the present rate of sea level rise is having on an area. The use of historic shoreline changes implicitly includes historic sea level rise. While there are no direct measurements of sea level rise for the immediate project area, the rate of rise may be around 1 foot per century. We have calculated that this rate of sea level rise is contributing 1 to 2 feet of shoreline recession per year in North Carolina. Accordingly, should the rate of sea level rise double, the sea level rise component for shoreline recession would increase to 2 to 4 feet per year. While not insignificant, these incremental rates are not unmanageable and would not significantly impact our ability to maintain the project through periodic nourishment.

Note that in the formulation of the project, we had assigned a steady component of shoreline recession of 0.3 feet per year that would occur every year if the life cycle simulation did not include a storm in that particular year. There may have been some inference that this residual amount of shoreline recession was attributable to sea level rise. This was not the intent. Again, the method used to evaluate the project resulted in 50 year shoreline recession amounts within each shoreline segment equal to the 50 times the annual erosion rate used by the State of North Carolina Division of Coastal Management. Our method simply provided a method to evaluate variable amounts of erosion from year to year throughout each 50-year life cycle simulation.

**4.06.134 USGS Comment: Page D-39, Section g. Issues Addressed by Modeling, 4) Maintenance at Oregon Inlet:** The statement is made that the beach

nourishment process of adding over 66 million cubic yards to the coastal sediment budget will have only minor effects on the coastal processes, but there is not sufficient information to support this conclusion. With a southerly net transport of littoral drift, infilling and migration of Oregon Inlet could accelerate following the renourishment. In addition, with a robust coastal storm, the increased sand in longshore transport to the south could fill the navigation channel through the inlet and possibly constrict or even seal off Oregon Inlet. This issue is in need of further scientific investigation.

**Corps Response:** See response to USFWS comment 4.06.51 and 4.06.52

## **5.00 NORTH CAROLINA STATE AGENCIES**

### **5.01 N.C. Department of Environment and Natural Resources (NCDENR), letter dated August 28, 2000.**

**NCDENR Comment:** The attached comments identify a number of concerns that should be dealt with in order for the Corps of Engineers to produce an acceptable Final Environmental Impact Statement (FEIS). Addressing these issues will not only help our regulatory divisions but will provide greater assurances to this department that the impacts resulting from the proposed action will be avoided or minimized. The Corps of Engineers is encouraged to work directly with our divisions prior to submitting the FEIS to the State Clearinghouse for review so unnecessary delays can be avoided.

**Corps Response:** Noted.

### **5.02 N.C. Wildlife Resources Commission (NCWRC), letter dated August 17, 2000**

**5.02.1 NCWRC Comment:** The U.S. Army Corps of Engineers conducted feasibility studies on 20 miles of Dare County oceanfront located north of Oregon Inlet. The studies address the possibility of future beach nourishment projects along 14.8 miles of oceanfront in Nags Head, Kitty Hawk, and Kill Devil Hills. The preferred plan includes initial nourishment and 50 years of subsequent nourishment. According to the syllabus and pages 79 & 83 the total cost of the project would be 994 million dollars. Other information in this document indicates a different total cost of the project.

**Corps Response:** The \$994 million evidently was arrived at by taking the first cost of the project (\$69,518,000) and adding 50 years of cost at the average annual cost of  $(\$18,494,000 \times 50 = \$924,700,000)$  for a total of \$994,218,000. The average annual cost is an economic cost which is the first cost amortized over 50 years plus the total present worth of future nourishment cost amortized over 50 years. Non-inflated expected annual costs for the project are estimated at \$18.2 million. A total project cost summary adjusted for inflation can be found in Appendix G.



**5.02.2 NCWRC Comment:** We request the following issues be thoroughly addressed in the Final Environmental Impact Statement.

1. The document includes the following statements:

"There are no areas of controversy for this study."

"Overall environmental impacts are expected to be minor. .."

"No significant impact on biological resources is expected. .."

"Since stable, productive bottom will be avoided there should be very little impact associated with the borrow areas."

The above statements possibly contradict information included in the Draft EIS. Fourteen federally listed endangered and threatened species occur in the study area. Initial construction will take three years to complete with dredging and beach nourishment occurring year round. Periodic nourishment will occur every year along some segment of the project area for 50 years. The chronic environmental impacts to the borrow areas and beaches from annual long-term dredging requirements may preclude the recovery of invertebrate populations as an important food source for fish and wildlife species. Portions of the habitat present in or near the proposed borrow areas are used for spawning, nursery, staging, foraging, and/or summer and wintering grounds for numerous species of fish, marine mammals and migratory birds. The borrow areas are included in a larger area designated as essential fish habitat for numerous species of fish.

**Corps Response:** Section 1.02 "Areas of Controversy or Significant Concern" has been added to the FEIS to further discuss these matters. Additionally, we have expanded our cumulative impacts section (see Section 6.01.0 of the FEIS).

**5.02.3 NCWRC Comment:** 3. In section II, Past Hurricanes and Northeasters, the document neglected to provide the cost of damages in the study area for the six hurricanes since July 1996. These actual costs of damages in the study area would appear to be more applicable in performing a cost/benefit analysis than computer estimates based on probabilities of hurricane occurrence, intensity and unpredictable impacts to North Carolina's coast. In section III, Potential Benefits for Hurricane and Storm Damage Reduction, the computer model used long-term progressive erosion together with storm damages to generate the projected annual hurricane and storm damage reduction estimate for the study area. Is it appropriate to include long-term erosion trends for this cost estimate?

**Corps Response:** The Water Resources Development Act of 1986 (WRDA 1986) recognizes two purposes for beach nourishment projects, storm damage reduction and recreation. WRDA 1986 stipulates that damages associated with long-term erosion be treated as storm damages.

Where available, damage estimates for these relatively minor storms affecting the Bodie Island beaches of Dare County were compared with the model results for

calibration purposes. Fortunately, for this region, since their development boom of the 1980s, they have not incurred the more devastating kinds of storms randomly thrown at these beaches by the model. The storms selected by the model are not probabilistic but randomly generated for each year of the 50-year period of analysis. The long-term erosion rate is appropriately accounted for in each year in this life-cycle approach before subjecting the beach to that year's randomly generated storms.

**5.02.4 NCWRC Comment:** 4. We again request a history of North Carolina beach nourishment projects (including subsequent nourishment) and their effectiveness pertaining to yearly erosion and protection during major storm events. The Corps of Engineers should also show the longevity of the nourished areas once the beach nourishment efforts expired.

**Corps Response:** See response to USEPA comment 4.05.7. In summary, the Wrightsville Beach and Carolina Beach projects have been in operation since 1965 and have provided essentially continuous protection against coastal storm damage and coastal erosion. There was a period of about 8 to 10 years between the early 1970's and 1980 during which time the beach projects were not properly nourished due to budgetary constraints. During this period, both projects suffer considerable erosion but did not completely vanish. Routine nourishment of both projects, Carolina Beach about every 3 years and Wrightsville Beach approximately every 4 years, has been accomplished since the early 1980's. As a result, both projects have remained in a fully functional mode. The projects will continue to provide the same degree of protection as long as periodic nourishment continues. In this regard, periodic nourishment of the coastal storm damage reduction projects is included as part of the plan formulation process with the periodic replacement of lost sand treated as a construction feature for coast sharing purposes. In other words, periodic nourishment is a recognized, scheduled, and budgeted requirement for beach nourishment of projects.

### **5.03 N.C. Division of Marine Fisheries (NCDMF), letter dated August 15, 2000**

**5.03.1 NCDMF Comment:** The North Carolina Division of Marine Fisheries has reviewed the referenced document and submits the following comments.

The study discloses that the most practicable plan of protection for the primary study area is a berm and dune project extending along approximately 14.8 miles on the oceanfront at Nags Head, Kill Devil Hills and Kitty Hawk. The recommended plan of improvement consists of a sandy dune constructed to an elevation of 13 ft. above the National Geodetic Vertical Datum (NGVD), fronted by a 50 ft. wide beach berm constructed to an elevation of 7 ft. above NGVD. The project accomplishment is the reduction of hurricane and storm damages and beach erosion. In addition, the project will enhance the beach strand available for recreation use.

First costs of the total project are currently estimated at \$69,518,000, with expected annual costs estimated at \$18,494,000. Expected annual benefits estimated at

\$32,644,000, the total project benefit -cost ratio is 1.8. This plan fits the National Economic Development Plan (NED), which requires that the maximum net economic benefit be produced.

The Document states that the recommended plan of improvement is considered to be environmentally acceptable. Initial project construction and periodic nourishment could affect some threatened species and the existing fauna.

Both a pipeline dredge and a hopper dredge with pump out capability are proposed to be used for initial construction and periodic nourishment. A periodic nourishment operation will occur every year along some segment of the project area, with each segment being renourished on a three-year cycle.

Potential borrow areas for beach fill are located offshore, beyond the 30 ft. NGFD contour and inside the 3 mile nautical limit. The material in the southern borrow area (S-I) and the northern borrow areas (N1 and N2) is ideal for beach nourishment, with less than 10 percent in fines.

**Corps Response:** Noted.

**5.03.2 NCDMF Comment:** The Division is concerned with the adverse impacts that will occur from the project. Biological resources will be affected by dredging of material for initial project construction and by placement of material on the beach. These impacts will reoccur as the area is renourished.

As stated in the document the surf zone and the nearshore waters are utilized by kingfishes, spot, croaker, bluefish, weakfish, spotted sea trout, summer flounder, striped bass, spiny dogfish, Atlantic sturgeon and other commercially and recreationally important species. The offshore marine waters serve as habitat for the spawning of many estuarine dependent species. The Atlantic migratory striped bass population utilizes the area as overwintering grounds. Spiny dogfish also utilize the area for pupping grounds. During project construction and renourishment, commercial and recreational fisheries that occur in the area will be impacted or precluded. The impacts to the commercial and recreational fisheries utilizing the area need to be evaluated. Extensive recreational fisheries occur in the surf, as well as hook and line fishing from fishing piers and private and charter boats along the entire project area and in the borrow areas. Traditional commercial fisheries in the project area include beach seines, gill netting and trawling. Negative economic impacts would result from the fisheries being restricted or precluded in these areas for extensive periods of time during the initial project and during renourishment. Utilizing a hydraulic pipeline dredge would require the pipeline to be submerged from the dredge to a point close to shore. The placement of the pipeline would result in a hazard to navigation and preclude any fishing activity in the area. The proposed fill on the beach would move the shoreline seaward under ocean piers, reducing the available fishing area.

**Corps Response:** See response to comment 4.04.4.

**5.03.3 NCDMF Comment:** The Division is concerned with the increased turbidity levels that will result from the project. Displacement of various finfish species utilizing the area will likely occur. Even though the document states that the increases in turbidity and suspended materials is not expected to be greater than during storm events, this project will be a long term event, with prolonged periods of increased turbidity. Concern is also expressed with the impacts to the intertidal macrofauna. Even though recovery is rapid once the pumping operation ceases, due to the frequency of nourishment the Division would question the macrofauna recovery.

**Corps Response:** The discharge of dredged material on the beach will increase turbidities in the nearshore zone. The turbidity in the plumes is expected to be similar in magnitude to conditions encountered during storm events. However, the spatial extent of elevated turbidities associated with beach fill are relatively small. Van Dolah et al. (1994) determined the spatial extent of turbidity plumes associated with a beach nourishment at Folly Beach, South Carolina. They found that the turbidity plume as determined by measurements of NTUs extended approximately 1,000 m in a down longshore current direction at a distance of 15 m from shore and 500 m at a distance of 30 m from shore. Turbidity levels were variable depending on local weather conditions. During periods of calm winds and seas, turbidities of about 100 NTUs were measured at the discharge. If displacement of finfish occurs, those effects will be restricted to a limited area down current from the dredged material discharge point.

Van Dolah, R.F., Martore, R.M., Lynch, A.E., Levinsen, M., Wendt, P.H., Whitaker, D.J., and W.D. Anderson. 1994. Environmental Evaluation of the Folley Beach Nourishment Project. Final Report to the U.S. Army Corps of Engineers Charleston District. Marine Resources Division, South Carolina Department of Natural Resources, Charleston, SC.

**5.03.4 NCDMF Comment:** The importance of the area for a variety of finfish species was previously noted. This agency would be concerned with the entrainment impacts to larvae and juvenile species utilizing the area. The physical limitation of these stages make them potentially more susceptible to entrainment by an operating hydraulic or hopper dredge.

**Corps Response:** Entrainment impacts are discussed in FEIS Section 6.04.2. This discussion notes that larval and juvenile stages of finfish species are subject to a higher risk of entrainment because their powers of mobility are either absent or poorly developed, leaving them subject to transport by tides and currents. However, past direct quantification studies and modeling efforts have not demonstrated population level impacts due to larval entrainment by hydraulic dredging.

In addition, the likely insignificance of larval entrainment impacts in the open ocean may be put into perspective through an example that compares the pumping rate of an operating dredge to some specific volume of water, such as that which occurs

over borrow area S1. A hydraulic dredge likely to work in this environment could be assumed to have a discharge pipe about 30 inches in diameter and would be capable of relocating about 40,000 cubic yards of sand per day if operated 24 hours. The sediment would be pumped as a slurry consisting of roughly 15% sand and 85% water by volume. The volume of water pumped through the dredge in this example would, thus, be about 226,700 cubic yards per day. If borrow area S1 is 5,700 acres and the average water depth over this area is 40 feet, then this water mass would have a volume of approximately 367,840,000 cubic yards. Therefore, the amount of water intercepted by the operating dredge in a 24-hour day (226,700 cubic yards divided by 367,840,000 cubic yards) is estimated to be less than 7/10ths of 1% of the water located over the borrow site. Because of this relatively small amount of water passing through the dredge as compared to volume of water at the borrow site, entrainment impacts are expected to be minor also. When compared to the volume of water in the open ocean, even on a regional basis, the volume of water pumped by a hydraulic dredge appears negligible.

#### **5.04 N.C. Marine Fisheries Commission (NCMFC), letter dated August 24, 2000**

**5.04.1 NCMFC Comment:** In general, the MFC finds that beach dredging and augmentation projects rarely provide adequate assessment or consideration of potential damage to fishery resources under state and federal management, and this project is no exception. Historically, emphasis has been placed on the logistics of sand procurement, related economics, and compliance with limitations imparted by the Endangered Species Act for sea turtles, piping plovers and other listed organisms. Too little attention has been paid to impacts on fisheries resources at either sand source sites or sand application sites, and certainly with too little concern for where the applied sand will end up once it moves off the beach. Also, too little attention has been paid to impacts on commercial and sport fisheries.

**Corps Response:** Noted.

**5.04.2 NCMFC Comment:** The proposed project is very large in both geographic and temporal scale, and presents a very significant threat to resources under MFC management authority. The project area impinges directly on essential fish habitats designated by the South Atlantic Fishery Management Council for red drum, penaeid shrimps, portions of the snapper grouper complex (including estuarine-dependent forms like gag grouper and black sea bass), portions of the coastal migratory pelagic complex, possibly calico scallop habitat (including quartz sands NE of Cape Lookout from 62 feet to 102 feet), and pelagic sargassum. The project also has direct implications for essential fish habitats designated by the Mid-Atlantic Fishery Management Council for summer flounder, bluefish and spiny dogfish. The project area also includes fish habitat in the process of being designated for special attention by the State of North Carolina through the "coastal habitat protection planning" provision of the 1997 Fisheries Reform Act (G.S. 143- 279.8). The sand source areas include known winter aggregation sites for a wide array of

economically and ecologically important fishes managed by the Atlantic States Marine Fisheries Commission, including striped bass, Atlantic sturgeon, and weakfish. With this extreme involvement with essential fish habitats, special care is needed.

**Corps Response:** Your concerns are noted but we disagree that the project poses a significant threat to marine resources.

**5.04.3 NCMFC Comment:** The draft consistently understates the potential impact on these resources. Repeated and long-lasting dredging in essential fish habitats has never been reliably evaluated in terms of impacts on fishery resources or fisheries. Disruption of bottom physical structure of an artificial and continual disturbance regime, creation of artificial topography, turbidity in the water column, alteration of surficial sediment size-distributions inside depressions, impacts on prey organism distribution and abundance patterns (both benthic and in the water column), and a variety of other effects in concert create a very significant disturbance of this extremely important marine ecosystem.

**Corps Response:** Virtually all coastal waters of North Carolina have been designated as Essential Fish Habitat (EFH), therefore it is incorrect to state that impacts of repeated dredging on EFH have never been evaluated since our navigation channels are also in EFH and have been evaluated many times. However, we agree that there are unanswered questions regarding the impacts of the project on the environment. For this reason we have agreed to monitor project effects as indicated in Section 6.12.2 of the FEIS.

**5.04.4 NCMFC Comment:** The proposed alteration of about 800 acres of habitat in the critical overwintering area in N1 by itself is enough to warrant further analyses and mitigative efforts. Spiny dogfish are severely overfished, with serious depletion of large females most important as brood stock. Further impacts on these fish as they overwinter could threaten the rebuilding plan just adopted by the U.S. Department of Commerce. Rebuilding is underway as well for various striped bass stocks, which also overwinter in this area.

**Corps Response:** Noted. We are willing to work with the NMFS as we develop our monitoring plan for the area so that we can develop a data set useful to both agencies.

**5.04.5 NCMFC Comment:** Repeated artificial disturbance of the surf zone and associated turbidity also has great potential to damage fish and crab larvae moving to and through Oregon Inlet and into Pamlico Sound. The best current information suggests that larvae move onshore and then along shore prior to entrainment into inlets. The risks to this most critical life-stage of North Carolina marine resources are not well-known, but of great concern.

**Corps Response:** As discussed in the response to comment 5.03.2, the discharge of dredged material on the beach will increase turbidities in the nearshore zone. The turbidity in the plumes is expected to be similar in magnitude to conditions encountered during storm events. However, the spatial extent of elevated turbidities associated with beach fill are relatively small i.e., approximately 1,000 m in a down longshore current direction at a distance of 15 m from shore and 500 m at

a distance of 30 m from shore. Oregon Inlet is greater than 4 miles (6.4 km) away from the southern limit of the project. Considering the extent and magnitude of the expected turbidity plumes associated with the beach fill, the probability of the proposed beach fill having adverse effects on larvae entering Pamlico Sound through Oregon Inlet is very low. See response to comment 4.02.2 above.

**5.04.6 NCMFC Comment:** Scientific work is underway to better characterize these potential impacts. The MFC feels it is premature to embark on a project of this magnitude until its likely effects are known. Certainly, the potential for negative effects impacts is not adequately characterized in the draft.

**Corps Response:** See response to comment 4.02.2 above.

**5.04.7 NCMFC Comment:** In addition, the MFC has adopted a specific policy of "net enhancement" for projects with the potential to significantly damage the marine and estuarine resources of North Carolina. The project is clearly out of compliance with the MFC's "net enhancement" policy (attached). Only the most cursory analyses of impacts on those resources are presented in the documents, and no significant attempt to minimize and then mitigate likely impacts have been proposed. Until such time as credible analyses are presented that demonstrate that the project has no net negative impact on the marine and estuarine resources of North Carolina, the MFC will continue to recommend denial of any and all state actions to allow the project to proceed. We request that this project be found inconsistent with the state's coastal zone management plan unless and until such analyses are completed.

**Corps Response:** We disagree that there is a significant risk to marine and estuarine resources. However, we recognize that there is agency concern regarding this issue and have therefore agreed to monitor project impacts.

**5.04.8 NCMFC Comment:** The MFC also finds that piecemealing of the environmental evaluations of beach augmentation projects, in the face of overwhelming demand for such projects, necessarily results in inadequate evaluation of the relative merits and deficiencies of these projects. While it seems unavoidable that some sand will be moved to artificially enhance certain beaches, the relative pluses and minuses of those projects cannot be assessed under the current approach. This problem is particularly acute given the rush to augment beaches after recent hurricanes. The supply of appropriate sand is limited in both state and federal waters, and the correspondence between areas with appropriate sand and important fish habitats is quite high. The cumulative effect of all these projects currently active or proposed for the North Carolina coast constitutes a potentially serious threat to the marine resources under state and federal management.

An integrated assessment should be conducted of the relative economic merits and the relative environmental harm of the entire slate of projects under consideration for coastal North Carolina. The exclusion of the Highway 12 section of the study area makes assessment of the cumulative impacts of the proposed activity in the area scientifically impossible.

Segmenting the environmental analyses of artificial beach augmentation activities under a variety of plans on a variety of temporal tracks all over the coast prevents any optimization of benefits and environmental impacts.

Unfortunately, the timing of the proposed project (and all the others) is particularly bad. The MFC is currently in the process of developing, along with the Environmental Management Commission and the Coastal Resources Commission, a Coastal Habitat Protection Plan (CHPP) for the Coastal Ocean, as required by the NC Fisheries Reform Act of 1997. The law requires the development and implementation of plans which provide a net enhancement of the value to the fishery resource of a long list of habitat types, including many potentially affected by redirection of sand. The Coastal Ocean CHPP will address problems with beach dredging; it will not even be available in draft until next year.

We suggest that the current suite of federal activities and expenditures related to beach augmentation comprise a real and significant threat to the marine and estuarine resources of the state of North Carolina, including the subject project. We ask the state to not approve consistency determinations on beach dredgings and augmentation projects until an adequate assessment of the cumulative impacts of these projects is conducted and impacts on marine and estuarine resources are shown to be insignificant. Moreover, that analysis should be conducted in coordination with the development of the integrated fish habitat protection strategies in the Coastal Ocean CHPP, currently under development.

Barring such a comprehensive analysis, the MFC requests that adequate analyses of direct and indirect impacts of the proposed project on the marine resources of North Carolina be undertaken, and that impacts on those resources be clearly and carefully considered before federal action is taken.

**Corps Response:** We have revised our analysis of cumulative impacts of beach nourishment projects and the likely contribution of the proposed project., in response to comments on the DEIS. Please see our analysis in Section 6.11.

As stated in the EIS, we do not believe that the proposed project will comprise a real and significant threat to the marine and estuarine resources of the State of North Carolina. The EIS addressed the impacts of dredging, impacts on entrainment of marine organisms, commercial and recreational fisheries, EFH, the Cape Hatteras Sandy Shoal, the Point, Sargassum, reef-forming corals, artificial reefs, hardbottoms, State-designated areas important for managed species, the marine water column, near shore ocean invertebrates, beach invertebrates, and near shore ocean birds. Our assessment of impacts is based on existing available data, which is admittedly lacking in some areas. For this reason, we agree to consider the recommendations for monitoring provided by the U. S. Fish and Wildlife Service (USFWS), Draft Fish and Wildlife Coordination Act Report, dated July 1999 and included as Appendix B of the EIS. The monitoring plan will be developed in coordination with the Fish and Wildlife Service and the National Marine Fisheries Service, as described in Section 6.12.2 of the FEIS.



**5.05 N.C. Department of Environment and Natural Resources (NCDENR), checklist dated August 18, 2000.**

**5.05.1 NCDENR checklist comment:** After review of this project it has been determined that the ENR permit(s) and/or approvals indicated may need to be obtained in order for this project to comply with North Carolina Law.

**Corps Response:** Noted.

**5.05.2 NCDENR checklist comment:** Any open burning associated with subject proposal must be in compliance with 15 A NCAC 2D.1900.

**Corps Response:** Noted.

**5.05.3 NCDENR checklist comment:** May require 401 Water Quality Certification

**Corps Response:** Noted.

**5.05.4 NCDENR checklist comment:** Compliance with 15A NXAC 2H 1000 (Coastal Stormwater Rules) is required.

**Corps Response:** Noted.

**5.05.5 NCDENR checklist comment:** This is a mosquito breeding area. Construction plans and operations should include awareness of this. The applicant should contact the Public Health Pest Management at (252) 762-8970 for a site visit or information to help prevent the creation of more mosquito habitat.

The applicant should contact Scott Sawyer with Mosquito Control in Dare County at (252) 473-1101.

**Corps Response:** The proposed beach nourishment project should not create any mosquito breeding habitat; however, we will contact the mosquito control office during preparation of plans and specifications.

**5.06 N.C. Division of Coastal Management (NCDCM), memorandum dated July 20, 2000**

**NCDCM Comment:** This project will be reviewed for consistency with the NC Coastal Management Program pursuant to federal law and or NC Executive Order 15. Agency comments received by SCH are needed to develop the State's consistency position. Proposal is in draft form, a consistency response is inappropriate at this time. A Consistency Determination should be included in the final document.

**Corps Response:** Noted.

**5.07 N.C. Department of Cultural Resources (NCDCCR), memorandum dated August 31, 2000.**

**NCDCCR Comment:** The NC Department of Cultural Resources does not have any comments on the proposed action.

**Corps Response:** Noted.

## **6.00 LOCAL AGENCIES**

**6.01 The Outer Banks Chamber of Commerce (OBCC), letter dated July 28, 2000**

**OBCC Comment:** The OBCC supports the proposed action.

**Corps Response:** Noted.

**6.02 Oregon Inlet Users Association (OIUA), letter dated August 29, 2000**

**6.02.1 OIUA Comment:** What plans & funding have been offered to deal with the potential increase of sediment (sand) that most certainly will be a result of beach nourishment in Nags Head as relates to maintaining the navigation channel at Oregon Inlet?

**Corps Response:** See response to USFWS comments 4.06.51 and 4.06.52. Sediment transport to the south toward Oregon Inlet is predicted to increase linearly from zero in the first few years following construction of the storm damage reduction project to around 13 percent at the end of the 50-year project life. Of the increased volume of sediment transported to the inlet, only a relatively small percentage is expected to actually shoal the channel. For example, the existing navigation channel captures approximately 25 percent of the gross littoral drift moving toward the inlet. Note that gross drift is the sum of material moving along the shoreline in both the north and south directions. Assuming that the additional sand arriving at the inlet from the nourishment project shoals the channel by the same percentage, shoaling of the Oregon Inlet navigation channel would only increase by a maximum of 3 to 4 percent by the end of the 50-year project life. However, shoaling would be much less than this during the majority of the 50-year period. Generally, shoaling increases of this magnitude are not discernible as the volume lies within the error band associated with the survey data. Accordingly, the Dare County project would not have a measurable impact on shoaling of the Oregon Inlet ocean bar channel.

**6.02.2 OIUA Comment:** What studies have been conducted as to the effects a north jetty would have on slowing the erosion, (i.e. the funneling effect of Oregon inlet) to the north of Oregon Inlet?

**Corps Response:** The Oregon Inlet stabilization project, and its associated sand management plan, is predicted to stabilize 3 miles of shoreline north and south of the inlet. The inlet project will also be responsible for project related impacts that occur 6 miles north and 6 miles south of the inlet. Impacts of the inlet project on the Dare County coastal storm damage reduction project would be minimal to non-existent.

**6.02.3 OIUA Comment:** Please share any info concerning the positive effects that sand bypassing at Oregon Inlet might have on old Highway #12 "Hot Spots" south of Oregon Inlet.

**Corps Response:** The Oregon Inlet stabilization project would prevent erosion of Pea Island for a distance of 3 miles south of the inlet. This 3-mile area includes the northernmost NC 12 erosion "hot spot" known as the "Canal Area." Note that any impacts of the inlet project are totally unrelated to the Dare County beaches storm damage reduction project.

**6.02.4 OIUA Comment:** Please include any information available as to the protective benefits that the stabilization project would have for the O.I. bridge and its approaches from both the north and south, and how this might tie in with the prospective beach nourishment.

**Corps Response:** Again, any impacts of the inlet stabilization project on the adjacent shorelines are not related to or dependent on the Dare County beaches project. As indicated above, the inlet project would stabilize 3 miles of shoreline north and south of the inlet, which, in turn, would protect existing approaches to the Oregon Inlet bridge.

**6.02.5 OIUA Comment:** Since it appears to be an ongoing problem to locate suitable spoil disposal sites for channel dredging on the sound side, what studies have been conducted as to the probable effects of placing the material in the surf zones or work areas of the nearest ocean beaches?

**Corps Response:** The Corps of Engineers is conducting a dredged material management study for the Oregon Inlet project, also known as the Manteo (Shallowbag) project. Consideration will be given to the possible disposal of beach quality material on the beaches adjacent to the inlet. However, any plan that would include beach disposal of this material would have to be coordinated with and acceptable to the National Park Service and the U.S. Fish and Wildlife Service. Shoal material removed from interior channels and deposited on the adjacent beaches would have no impact on the performance of the Dare County beaches storm damage reduction project.

**6.02.6 OIUA Comment:** And, what studies have been conducted as to the actual grain sizes and their compatibility, from areas other than the lower portion of the interior channels, sound side?

**Corps Response:** The dredged material management plan, referenced above, will include analysis of the grain size distribution of the shoal material and its suitability and compatibility with native beach materials on the nearby beaches.

**6.02.7 OIUA Comment:** What studies have been conducted on the sound side to locate potential borrow sites from the sound?

**Corps Response:** Sound side borrow areas were not considered in the formulation of the present Dare County beaches storm damage reduction project. Previous investigations associated with an earlier feasibility study for the area, conducted in the early 1960's concluded that the grain size characteristics of the sound material did not match the characteristics of the native ocean beach material. Even if the sound side material was compatible with the native beach sands, the environmental damages associated with using sound side sources would negate this material as a viable borrow source.

**6.02.8 OIUA Comment:** Please address the potential effects of ocean dredging from the identified borrow sites to the naturally occurring storm bars that build and move onto the beach in a storm event in between the borrow areas and the shore.

**Corps Response:** The proposed borrow areas are located in water depths greater than 40 feet below National Geodetic Vertical Datum (NGVD). Significant sediment transport, particularly onshore transport, does not occur at these depths even during storm conditions. Bar formation during storms is the result of the offshore movement of sand from the immediate foreshore area. Once the storm passes and wave and tide conditions return to normal, the bars created by the storm are moved back to the shore. This process has been well documented by continuous beach profile surveys conducted by the U.S. Army Corps of Engineers Field Research Facility located at Duck, North Carolina since the early 1980's.

**6.02.9 OIUA Comment:** Please cite any scientific studies which relate to the removal of sand from the ocean side borrow sites and its long-term effects.

**Corps Response:** An analysis of the potential impacts of removing sediment from the offshore borrow areas on shoreline behavior in the project area was conducted as part of the feasibility study. This analysis assumed the worst case scenario in which all of the potential borrow material was removed from the designated borrow sites. This assumption resulting in depth increases of 10 to 15 feet in the offshore areas. The results of this analysis, which evaluated changes in wave transformation/sediment transport potential associated with these deeper offshore depths, indicated only minor changes in the sediment transport potential along the study area beaches. These minor changes would not have any measurable impact on the stability of the beaches north of Oregon Inlet.

**6.02.10 OIUA Comment:** For whatever studies that are cited for the above questions, please send a copy.

**Corps Response:** A copy of the final report addressing the borrow area impacts on the beaches will be provided.

**6.02.11 OIUA Comment:** I find it interesting that this was sent to me personally, and can only attribute it to the many years of effort I have spent working for stabilization of Oregon Inlet as head of the Oregon Inlet Users Association.

**Corps Response:** Noted.

**6.02.12 OIUA Comment:** A word to the wise to all (supporters of this beach nourishment project) - over the years there have been many promises by our elected officials that the Oregon Inlet Stabilization Project would be done, and it was authorized and funded by Congress in 1970, yet it still remains undone?

**Corps Response:** Noted.

**6.02.13 OIUA Comment:** Please understand that I am not opposed to beach nourishment at this time, north or south of Oregon Inlet. However, I would appreciate answers to my questions and receiving the supportive data and inclusion of same in your Feasibility Report and Impact Statement.

**Corps Response:** Noted.

## **7.00 ELECTED OFFICIALS**

**7.01 Dare County Board of Commissioners (DCBC), letter and resolution dated August 11 and August 7, 2000, respectively.**

**DCBC Comment:** The Board supports the proposed action.

**Corps Response:** Noted.

**7.02 Mayor Clifton G. Perry, Town of Kitty Hawk, letter and resolution dated August 2, and August 7, 2000, respectively.**

**7.02.1 Town of Kitty Hawk Comment:** At the most recent applicant briefing, the Town of Kitty Hawk requested that the U.S. Army Corps of Engineers further explore the expansion of the Dare County Beaches Hurricane Protection and Erosion Control Project northward in the Town of Kitty Hawk to the Town boundary. The outcome of this additional study was that the Corps of Engineers could not justify the expansion of the project.

**Corps Response:** It is true that the outcome of this additional study was that the Corps of Engineers could not justify the expansion of the project to cover all of Kitty Hawk. However, we propose to take another look at this area during Pre-construction, Engineering and Design Phase and test its feasibility for inclusion.

**7.02.2 Town of Kitty Hawk Comment:** Currently, the Town has witnessed that the area to the north of where the project has been targeted is experiencing the majority of impacts from the ocean forces. The problems associated with the lack of a protective berm and the higher rates of erosion north of the proposed project area result in; severe erosion, ocean overwash and inundation of interior lots, loss of portions of NC12 with the potential to lose more, private property damage, clean-up following overwash events, and public health and safety issues. Each of the problems just mentioned will continue to intensify without the relief that an erosion control project will offer.

**Corps Response:** See response to comment 7.02.1..

**7.02.3 Town of Kitty Hawk Comment:** Once again, I have provided attachments to better explain the reasons why the Town would like to see the project expanded. At the beginning of the study process, it appeared that the entire oceanfront in Kitty Hawk had been targeted for this project. If the project is constructed as it is now proposed, the Town Council and the citizens of Kitty Hawk will be left with many questions regarding "why the worst areas of Town were not part of the targeted project area."

**Corps Response:** See response to comment 7.02.1.

**7.03 Mary E. Quidley, Town Clerk, Town of Kill Devil Hills, letter and resolution dated July 28, and July 26, 2000, respectively**

**Town of Kill Devil Hills Comment:** The Town supports the proposed action.

**Corps Response:** Noted.

**7.04 J. Webb Fuller, Town Manager, Town of Nags Head, letter and resolution dated August 8, and August 2, 2000, respectively**

**Town of Nags Head Comment:** The Town supports the proposed action.

**Corps Response:** Noted.

**8.00 CONSERVATION GROUPS**

**8.01 Biodiversity Legal Foundation (BLF), letters dated August 28, August 30, 2000, September 12, 2000, respectively.**

**8.01.1 BLF Comment:** This letter is in response to a letter dated August 29, 2000 from Colonel James DeLony, denying the Biodiversity Legal Foundation's (BLF) request for a month long comment extension, and the conversation that I had with you yesterday afternoon. If a comment letter from the BLF, were received by the Corps within two weeks of the deadline, would it be part of the official administrative record on the Dare Beaches DEIS/Feasibility Report.

**Corps Response:** Yes. The comment letter from the BLF was received on September 12, 2000, and has been fully considered, and included as a part of our administrative record.

**8.01.2 BLF Comment:** The Biodiversity Legal Foundation ("BLF") is a non-profit, science based conservation organization dedicated to the preservation of all native wild plants and animals, communities of species and naturally functioning ecosystems. Through reasoned educational, administrative and legal actions, the BLF endeavors to encourage improved public attitudes, policies and actions for all living things.

**Corps Response:** Noted.

**8.01.3 BLF Comment:** The BLF submits the following comments on the "Draft Feasibility Report and Environmental Impact Statement on Hurricane Protection and Beach Erosion Control, Dare County Beaches (Bodie Island Portion)." Due to the significant economic and ecological costs, we urge the U. S. Army Corps of Engineers ("Corps") not to select the ocean sand mining and beach disposal proposal.

**Corps Response:** The report findings indicate that the recommended plan of improvement is economically feasible and environmentally acceptable.

**8.01.4 BLF Comment:** Page 4, ¶ 6. The statement that material from the Oregon Inlet dredging project "has been placed on the beach" is no longer correct, as the Corps has abandoned using a pipeline dredge (which did deposit the sand on the beach). Currently, the sand is deposited offshore by a hopper dredge. The estimates regarding the depth at which the sand is deposited range from 14 to greater than 20 feet. A serious concern is that a large portion of the sand deposited in this manner does not return to the beach, resulting in artificially increased erosion rates on Pea Island.

**Corps Response:** Noted.

**8.01.5 BLF Comment:** Page 5. The map of the jetty project utilizes a 1985 date; the 1999 Corps DEIS revised the proposed project.

**Corps Response:** Noted.

**8.01.6 BLF Comment:** Page 6, ¶ 1. Stating there are "no areas of controversy for this study" makes us question whether the Corps read the Draft Fish and Wildlife Service Coordination Report., which lists many issues that are controversial regarding the proposal.

**Corps Response:** This section has been revised to reflect areas of controversy raised by comments on the DEIS.

**8.01.7 BLF Comment:** In addition, we strongly object to any use of National Park Service lands for the ocean sand mining and beach disposal proposal, as we are concerned about the adverse environmental impacts, and we question the consistency of the proposed action with the laws governing the Cape Hatteras National Seashore. The Organic Act directs the NPS to "regulate the use" of the Seashore "by such means, and measures that conform to the fundamental purpose of said parks, monuments and reservations, which purpose is to conserve natural and historical objects and the wildlife therein and to provide for the enjoyment of same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations " (16 U.S.C 1). In addition to this general mandate, the enabling legislation contains a very restrictive limitation on the management of the lands (16 U.S.C. 459a-2):

**Corps Response:** The 3,000 foot long transition proposed for placement on the Cape Hatteras National Seashore was not permitted by the USDOL. The plan was revised to reflect this in the FEIS.

**8.01.8 BLF Comment:** Except for certain portions of the area, deemed to be especially adaptable for recreational uses, particularly swimming, boating, sailing, fishing, and other recreational activities of similar nature, which shall be developed for such uses as needed, the said area shall be permanently reserved as a primitive wilderness and no development of the project or plan for the convenience of visitors shall be undertaken which would be incompatible with the preservation of the unique flora and fauna or the physiographic conditions now prevailing in this area. We are concerned that the ocean sand mining and beach disposal proposal would adversely impact Seashore lands. The proposal would not leave the Park Service lands "unimpaired" for future generations, nor would it conserve wildlife, In addition, the proposal is the antithesis of 11 wilderness."

**Corps Response:** The 3,000 foot long transition proposed for placement on the Cape Hatteras National Seashore was not permitted by the USDOL. The plan was revised to reflect this in the FEIS.

**8.01.9 BLF Comment:** Page 7, ¶ 2. What data does the Corps have to support the statement that That "most " of the visitors "will be staying in the oceanfront areas"? Most of the structures in the County clearly are not "oceanfront," so we question how the statement can be accurate.



**Corps Response:** The District stands behind the statement with the understanding that "oceanfront areas" includes the second row of development as well as the first. In this area one finds practically all of the motels and about 2,400 homes—many of which are on the rental market.

**8.01.10 BLF Comment:** Page 7, ¶ 4. Based on information presented at the Outer Banks Task Force meetings, we understand the Outer Banks have, over the last several thousand years, undergone periods of erosion and accretion. However, recently, on eastern facing beaches, the dominant trend has been one of erosion.

**Corps Response:** Erosion is the dominant trend along the entire Outer Banks. Exceptions still exist, such as the portion of the study area just south of the Sea Ranch Motel and the south facing portion of Hatteras Island located immediately west of Cape Point at Cape Hatteras.

**8.01.11 BLF Comment:** Page 9, ¶ 2. The statement that there is a "severe erosion problem" - as well as many similar statements throughout the document - fails to acknowledge the true cause of the "problem." If people had not built too close to the ocean, there would not be any "problem." Rather than face up to their own responsibility, certain local interests, instead want the federal government to pay a huge amount of money to rescue people from the predictable results of their own decisions. People intentionally decided to build their houses, rental cottages, and businesses; no one forced them to choose the particular location. They did this to get the benefits of such a location - whether it is better views of the ocean, a shorter walk to the beach, or higher rates that accompany an oceanfront room. Now, after having reaped the benefits of an exclusive beachfront location, certain interests are asking for a hugely expensive, taxpayer funded bailout.

**Corps Response:** For the most part, the development in the study area that is presently at risk due to continued shoreline recession and storm impacts was constructed years ago, well back of the existing shoreline. Current management practices in North Carolina require new construction to be set back from the seawardmost line of stable vegetation 30 times the long-term erosion rate for small buildings and 60 times the long-term rate for larger buildings. The present vulnerability of the development within the study area is apparent testimony that the existing set back requirements and other coastal management practices are not, in and by themselves, adequate to prevent significant damage to coastal development.

**8.01.12 BLF Comment:** There are other serious concerns about this paragraph. First, there is not a "natural protective dune system," as is noted in this paragraph and in other sections of the document. The dune system, where it does exist, is not "natural" under any reasonable definition of the term (with the exception of certain areas at the Seashore). Rather, the artificial dunes were constructed by people utilizing sand fences, bulldozers, sand bags, vegetation, and other techniques.

**Corps Response:** Noted. "Natural" will be deleted.

**8.01.13 BLF Comment:** Second, "erosion" has not caused the dunes to be "lost." If buildings were not in the way, a natural dune could exist. The "problem" for certain people is that the dune would probably be at or behind the first row of buildings, which would not sufficiently "protect" the buildings. It is critically important for the Corps to acknowledge that under more natural conditions, as erosion occurred, the dune - and the beach - would continue to move westward, but the beach and dune area still would continue to exist. By trying to lock in the position of the beach to "Save" the buildings, people are destroying the very beach that they purportedly want to protect.

**Corps Response:** While these statements are basically true for undeveloped beaches, the problem at hand is how best to manage the shoreline where development exists. Congress has determined that protection of existing coastal development is in the public interest if the cost of doing so is less than that which we are trying to protect. If other options, such as abandonment and retreat offered more cost effective management practices, that would have been recommended. However, in this case, protection of the coastal structures and the provision of a recreational beach is more economical than allowing existing development to be lost to long-term erosion or destroyed by coastal storms.

**8.01.14 BLF Comment:** Page 23, ¶ 4. The claim that erosion will have "claimed" more than 1,000 structures does not acknowledge that most of the structures could be moved back from the ocean. This technique is not new; in 1888, the Brighton Beach Hotel on Coney Island was moved back 2,000 feet (Pilkey and Dixon, 1996). Relocation is a viable alternative that is preferable to the proposed activity. In addition, we note that statements in the document that relocation would result in adverse impacts are not supported by reference to data, nor does the Corps fully compare the impacts of the two alternatives. Rather, relocation is dismissed with an inadequate discussion.

**Corps Response:** Structures that are moved back incur a cost. Our method takes the structural value as a one-time loss in the year that long-term erosion reaches the structure. This "cost" could also be considered as a proxy to account for the cost of moving the structure if that is the course of action the property owner elects to take. Section 3.3.2 of Appendix H and the EIS have been revised to more fully discuss retreat and relocation.

**8.01.15 BLF Comment:** Page 24, ¶ 2. The modifying clause "If replenished as necessary" is a massive understatement that borders on being deceptive. We question if the people understand that there will be a continuing need for incredibly expensive replenishment actions on a continuing basis, and that this replenishment will have to occur indefinitely.

**Corps Response:** As clearly presented in the DEIS, protection of the area will involve periodic nourishment of the project. However, the time limit for this

protection is 50 years. Protection beyond this legal time limit will require additional Congressional authorization.

**8.01.16 BLF Comment:** We are also concerned that the statement here, and in other locations in the document, that the project will "provide protection" "against erosion" and "against wave overwash during hurricane and storm events" fails to disclose to the reader the significant limitations that are inherent in these statements. Volume II contains more detailed information on the coastal modeling, but most people will not review that technical information. The feasibility report should acknowledge that the proposed alternative may reduce damage and erosion under certain circumstances, but in particularly bad storms, severe erosion and property damage still would occur.

**Corps Response:** . Residual damages exist with the project in place, as shown on page 75 of the main report and on page H-29, section 4.9.

**8.01.17 BLF Comment:** Page 30, ¶ 2. We question whether development "is expected to continue" without ocean sand mining and beach disposal; instead, the Corps actions will influence whether people choose to build structures on the remaining vacant lots or build elsewhere. By telling people that their homes will be "protected," the Corps could be giving people a false sense of security. In turn, this results people building more structures in unsafe locations, and, when a large storm hits, higher damages.

**Corps Response:** The development of the remaining vacant lots in the study area is not dependent on the proposed project. The biggest building boom in the area, which was during the 1980s, occurred before the inception of this feasibility study. The fact that construction steadily continued through the 1990s had nothing to do with the proposed project. The Corps does not agree that beach nourishment projects lead to an intensification of development. History shows that the intensification comes with or without a project. See response to comment 4.06.10.

**8.01.18 BLF Comment:** Page 32, ¶ 4. The Corps' proposed action may be inflating the value of houses, because if these houses are less likely to be washed away, their value will increase. In turn, this gives the Corps a higher cost/benefit ratio.

**Corps Response:** As explained in Appendix H, section 2.2.2, in accordance with Federal guidelines, the value of structures used in the model is based on the depreciated replacement cost of the structure as it exists today. Structural values are not altered when the with project condition is evaluated.

**8.01.19 BLF Comment:** Page 32, ¶ 1. We strongly question, the conclusion that the value of household contents for residential structures is 50% of the structural value. We request data to support this conclusion. The reference to responses from "Dare County officials and realtors familiar with development" the very interests that are supportive of beach replenishment - is completely unpersuasive. It also goes

against common sense: these houses are rental houses or beach cottages that are not, with only very limited exceptions, expensively decorated or full of expensive extras. We are concerned that the Corps is overestimating the value of household contents; in turn, this provides an overly inflated cost/benefit ratio.

**Corps Response:** As explained in the revised section 2.2.3, Appendix H, the Corps continues to believe that content value set at 50 percent of structural value for these Dare County beach communities is reasonable and appropriate. However, the impact of using a lower percentage will be tested during the Pre-construction, Engineering and Design Phase of the study.

**8.01.20 BLF Comment:** Page 32, ¶ 3. We strongly question the conclusions regarding the expected annual hurricane and storm damages, The Corps does not adequately assess the possibility that a structure that is close to the ocean can be moved, thereby sparing it from destruction. The Outlaw family house in Nag's Head, for example, has been moved back, as of 1995, three times for a total distance of 600 feet over the past 100 years (Pilkey and Dixon 1996: 50). Thus, relocation can effectively reduce storm damages.

**Corps Response:** Relatively few lots exist in the study area that are sufficiently deep to allow multiple retreats as the one cited in the comment, making a plan of wholesale retreat impractical. See response to comment 4.06.11.

**8.01.21 BLF Comment:** Page 33, ¶ 4. We are concerned that throughout the document, the Corps overstates the potential benefits of the ocean sand mining and beach disposal proposal. At least in this paragraph, the Corps refers to damage "reduction" rather than "prevention," but we are concerned that this distinction may be lost on most readers.

**Corps Response:** In the final feasibility report, the word "prevention" will be changed to "reduction" where appropriate. Residual damages exist with the project in place, as shown on page 75 of the main report and on page H-29, section 4.9.

**8.01.22 BLF Comment:** Page 34, ¶¶ 3-4. We strongly object to the accuracy of the recreational benefit calculations, which the Corps claims will be \$6,346,000 annually. The Corps admits (H- 35 - 36):

The recreational benefits for this project analysis stem from improving the quality of the recreation experience, not from drawing more people. In general, the supply of beach exceeds the demand for beach recreation along this 20-mile stretch of beach. The project would not be the draw; it merely enhances the experience for persons using the beach

Given the ever increasing demand for beach vacations and second homes on the coast, it is not likely that these lost properties would lead to any net loss in visitation. A more likely scenario is that the properties that would be lost to erosion would be

replaced by more public parking, and new motels and homes would replace older ones along the second row of development from the ocean....

**Corps Response:** The comment correctly notes that recreation benefits are not claimed for increases in visitation under the with project condition. The unit day value method of computing recreation benefits for this feasibility report is consistent with Federal guidelines and the analysis has passed both technical and policy scrutiny.

**8.01.23 BLF Comment:** This same reasoning applies to the "quality of the recreational experience" that the Corps claims justify the recreational "benefits." As the beach retreats westward, people will just shift their use with the shifting beach. This is shown by the experience in Nags Head: houses that are now oceanfront were, only 25 years ago, on the third row of structures back from the ocean (Pilkey et al. 1998). Yet, this has not stopped the explosive growth rate in visitation to this area. We request that the Corps remove all recreational "benefits" from the cost/benefit equation

**Corps Response:** The recreation benefit is based on the enhanced recreational experience that would come from visiting the nourished beach rather than the eroding beachface that the comment describes. The unit day value method of computing recreation benefits for this feasibility report is consistent with Federal guidelines and are allowed as an incidental benefit. The recreation analysis has passed both technical and policy scrutiny.

**8.01.24 BLF Comment:** Page 37, ¶ 4. In addition to the species listed, royal terns and oystercatchers also have the potential to breed in the project area.

**Corps Response:** Noted.

**8.01.25 BLF Comment:** Page 37, ¶ 5. The dunes are not "natural," and accordingly, while they do have some habitat value (especially at the Seashore area of the project), it is important for the Corps to acknowledge how the artificial dunes adversely affect certain species.

**Corps Response:** The report has been revised to reflect that the dune system in the project area is man-made.

**8.01.26 BLF Comment:** Page 38, ¶ 2. The Corps says that the one site protected under the Coastal Barrier Improvement Act of 1991 is the Nags Head Woods; we question whether this is correct, for we understand that Cape Hatteras National Seashore also is included in the protected area status. In turn, this would limit destructive federal activities, and we question whether ocean sand mining and beach disposal would be consistent with the relevant restrictions.

**Corps Response:** The Coastal Barrier Improvement Act provides that the John H. Chafee Coastal Barrier Resources Systems consists of areas identified and generally depicted on the maps on file with the Secretary [of the Interior] entitled "Coastal Barrier Resources System." 16 U.S.C.A. Section 3503. The Cape Hatteras National Seashore is shown on the Coastal Barrier Resources System map as an "otherwise protected area not within the CBRS." The Cape Hatteras National Seashore is, therefore, not within the Coastal Barrier Resources System.

**8.01.27 BLF Comment:** Page 40, ¶ 4. We disagree with the conclusion that there are "no environmental constraints" that would "preclude implementation" of the proposed action. The Draft Fish and Wildlife Coordination Act letter from the Service lists many concerns that the Corps has apparently unduly minimized. These include adverse impacts to fish habitats, invertebrates, nesting and migrating shorebirds, nesting sea turtles, and Oregon Inlet.

**Corps Response:** With the new and revised text provided in this Final EIS, the Corps believes it has adequately described the resources of the project area and the projected impacts to them from the proposed action. Unfortunately, it will not always be possible to provide the level of detail desired by every reviewer. On balance, after reviewing the impacts to specific resources and the cumulative impacts of the action, we still do not believe the impacts are of such a magnitude as to preclude implementation of the proposed project.

**8.01.28 BLF Comment:** Page 42, ¶ 2. We request that the Corps elaborate on the conclusions that relocation plans "are seldom found to be economically feasible." Why? What assumptions underlie this conclusion? This is a very important issue and it is not appropriate for the Corps to give it such a short discussion.

**Corps Response:** The explanation requested is found in section 3.3.2, Appendix H.

**8.01.29 BLF Comment:** Page 47, ¶ 1. The statement that the "interval between periodic nourishment operations will be 3 years" is undercut by statements later in the text (page 64). Because of the manner in which the sand will be replenished, once the maintenance activities start, there always will be a part of the project area that is under construction. The "3 years" statement unduly minimizes the disruption that will exist as a result of the Proposal.

**Corps Response:** Agree. The text on page 47 has been revised to properly reflect that some portion of the project area will be receiving nourishment every year.

**8.01.30 BLF Comment:** We also object to the use of the term "nourishment" to describe the proposed action. "Nourish" means: "1. To provide with food or other substances necessary for life and growth; feed. 2. To foster the development of, promote; 'Athens was an imperial city, nourished by the tribute subjects' (V. Gordon Childe). 3) To keep alive, maintain: nourish a hope" (Soukhanov, 1992: 1239). Dumping mined sand on the beach does not "nourish" the beach; from the

standpoint of coastal geology, the beach itself would do just fine without our intervention. Indeed, this proposal would result in adverse ecological impacts to species that depend on or utilize beach habitats. It is inaccurate to suggest that such an action is "nourishing" the beach. We request that the proposed alternative be called "ocean sand mining and beach disposal."

**Corps Response:** Nourishment is an accepted coastal engineering term and will continue to be used in Corps documents.

**8.01.31 BLF Comment:** Page 52, ¶ 1, and page 53, ¶2. The Corps notes that the proposed alternative would "reduce the landward retreat of the beach," and on the next page, the Corps states that the proposed alternative would "reduce damages to upland development due to hurricane-wave overwash." These are important admissions. "Reduce" and "prevent" are very different results, yet, the Corps often uses "prevent" rather than "reduce" throughout the document. We request that the Corps replace "prevent" with "reduce."

**Corps Response:** Noted. We should be consistent. This is a storm damage reduction project.

**8.01.32 BLF Comment:** Page 61, ¶ 1. We do not believe that the proposed action or the other alternatives that involve ocean sand mining and beach disposal are "environmentally acceptable,"

**Corps Response:** We disagree. While various hard structure alternatives, which we did not pursue, would have been environmentally unacceptable, beach nourishment is generally considered to be an environmentally acceptable alternative and is favored by beach communities and state policies. As indicated in our revised analysis of dredging impacts, we continue to believe that impacts to the near shore ocean are acceptable.

**8.01.33 BLF Comment:** Page 64. We prefer that the structure relocation alternative be pursued. However, in the event the Corps chooses to proceed with the ocean sand mining and beach disposal proposal, then the project should be modified so that no sand is deposited on Cape Hatteras National Seashore. Thus, the "transition area" should be either started at a more northerly location or reduced in size. However, we would stress that the proposal should not damage or adversely affect Seashore lands or lands at Pea Island National Wildlife Refuge.

**Corps Response:** The transition zone for the southern reach project has been shortened in the final feasibility report to reflect the Department of the Interior's recent rejection of the Corps request for a special use permit.

**8.01.34 BLF Comment:** Page 71, ¶ 1. We are concerned about the long-term impacts of the proposal on the borrow areas, including the impacts to fish resources and the modification of wave action due to long term mining of sand.

**Corps Response:** See response to comment 4.02.2, and our revised analysis of borrow area impacts in the FEIS.

**8.01.35 BLF Comment:** Page 71, ¶ 4. Based on many areas where people routinely do not utilize walkover structures, we question the statement that access will be "restricted."

**Corps Response:** The purpose of wooden walkover structures is to ensure that pedestrian traffic does not trample planted dune grass. The purpose of the beach grass is to stabilize the dune portion of the project against wind losses. Wooden walkovers at public access facilities as well as for private property owners helps to ensure that the dune grasses and the dunes will be protected.

**8.01.36 BLF Comment:** Page 75, ¶ 1. We request that the Corps elaborate on the conclusions that the proposal will result in the reduction of storm damages by 71 and 83% for the primary study area and the total project area, respectively. We request additional elaboration on the assumptions and calculations that underlie the conclusions.

**Corps Response:** These percentages represent the residual damages with the project in place. For example, as explained further in section 4.10, Appendix H, "the effectiveness of the NED Plan at reducing hurricane and storm damages is about 72 percent  $(1 - (\$10,511,000 / \$37,863,000)) * 100\%$ ." This means that expected annual damages are \$37,863,000 without the project and \$10,511,000 with the project for the overall primary study area. The 83% (now 84%) refers to the reduction of hurricane and storm damages within the project limits.

**8.01.37 BLF Comment:** Page 75, ¶ 2. The Corps admits that there are "no provisions in the project to protect the area against storm-tide flooding occurring from increased water levels" in the sound. How would this affect damage calculations, if the expected damages from such storm surges were figured into the calculations? As the Corps is well aware, many of the damages during hurricanes can come from sound side flooding.

**Corps Response:** The expected damages with and without the project include some sound side flooding, but only buildings on the seaward side of Highway 158 Bypass (plus all of South Nags Head) are included in the database. The proposed dune and berm plans have no impact on these damages. In other words, the sound side damages are the same under with and without project conditions.

**8.01.38 BLF Comment:** Page 85. We question the accuracy of the cost/benefit calculation for the reasons Noted in this letter.

**Corps Response:** Noted. The procedures and calculations are consistent with Federal guidelines and have undergone technical and policy review.



**8.01.39 BLF Comment:** Page 86, ¶ 6. We question whether there will be "rapid recovery," given the virtually continual replenishment actions that will be necessary under the project.

**Corps Response:** Recovery of beach fauna will be an ongoing process. However, as noted in your comment, agencies suggest the possibility that recovery will never be fully completed in the project area because of the frequency of disturbance events. This theory is somewhat speculative and its significance is, therefore, uncertain. Almost every natural community on the landscape today is in a state of recovery, and few will ever achieve it before another disturbance event, such as logging, fires, or hurricanes, will impact them again. What is important is whether or not the ecological community fulfills the needs of the significant resources that depend on it. At other beaches in the state that are nourished with similar frequency as that being proposed here, significant resources such as shorebirds, surf zone fishes, and mole crabs can still be found in abundance. Monitoring proposed at the Dare County beaches is described in Section 6.12.2.

**8.01.40 BLF Comment:** Page 87. The Corps neglects to note that there is a confirmed nesting of a leatherback sea turtle on Hatteras Island and this species utilizes waters offshore of the project area. Thus, the proposal could also adversely affect the leatherback sea turtle and the loggerhead and green sea turtles also. The National Marine Fisheries Service and the U. S. Fish and Wildlife Service note several of the adverse impacts (1993: 6):

Sand sources may be dissimilar from native beach sediments and can affect nest site selection, digging behavior, incubation temperature (and hence sex ratios), gas exchange parameters within incubating nests, hydric environment of the nest, hatching success and hatchling emergence success (Mann, 1977; Ackerman, 1980; Mortimer, 1982; Raymond, 1984a). Beach nourishment can result in severe compaction or concretion of the beach. Trucking of sand onto project beaches may increase the level of compaction.

Significant reductions in nesting successes have been documented on severely compacted nourished beaches (Raymond, 1984a). Nelson and Dickerson (1988) evaluated compaction levels at ten renourished east coast Florida beaches and concluded that 50 percent were hard enough to inhibit nest digging, 30 percent were questionable as to whether their hardness affected nest digging and 20 percent were probably not hard enough to affect nest digging. They further concluded that, in general, beaches nourished from offshore borrow sites are harder than natural beaches, and, while some may soften over time through erosion and accretion of sand, others remain hard for 10 years or more. Nourished beaches often result in severe escarpments along the mid-beach and can hamper or prevent access to nesting sites,

**Corps Response:** Noted. The document has been modified to reflect that leatherbacks and Kemp's ridley sea turtles have also nested in North Carolina.

Sand compatibility is always a major concern with any project to build-up a beach as improper grain size can have significant impacts to nesting sea turtles and other beach fauna. We have assessed the material from the proposed borrow sites and found it to be compatible. However, even when compatible sands are placed, beach hardness can still be an issue. For this reason, all fill material seaward of the new dune line will be tilled upon completion of sand placement. It should be re-emphasized that the referenced study by Nelson and Dickerson was performed on Florida beaches where offshore sand deposits can carry a much higher fraction of pulverized corals. Their results there may not be directly transferable to North Carolina (Nelson, personal communication). To complicate matters further, in North Carolina we have found that many beaches that have not received any fill material have natural hardness values higher than that currently recommended by the USFWS (500 Cone penetrometer units). While the Corps recognizes the uncertainty surrounding this issue, we still propose to till the beach after completion of sand placement to assure that it is usable by nesting sea turtles.

**8.01.41 BLF Comment:** Page 89. We believe that the proposed project will adversely affect breeding, migrating, and wintering piping plovers due to adverse effects to feeding activities (reduction in invertebrate); in addition, the people who vacation in this area - drawn by the beach - may adversely affect the plover and sea turtles due to their activities (e.g., loose dogs, feral cats, recreational activities, etc.)

**Corps Response:** We recognize that the proposed project may affect piping plovers in the EIS in section 6.09.6. We do not expect impacts to breeding piping plovers, as they are not known to nest in the project area. The USFWS recently proposed the designation of critical habitat for piping plover in several locations along the North Carolina coastline. The project area is not within that proposed designation.

**8.01.42 BLF Comment:** Page 91. The Corps claims that maintenance dredging for Oregon Inlet will increase by only about 65,000 cubic yards per year. We question this conclusion, given the millions of cubic yards of sand that the Corps will be depositing on the beach, and the continuing millions of cubic yards of sand that will be necessary in periodic replenishment activities. We request that all assumptions underlying this conclusion be disclosed. We are very concerned that the Corps is creating a situation that will artificially increase the sand going into the inlet, and in turn, the shoaling. Then, the Corps will be able to turn around and argue for the necessity of their proposed jetties.

**Corps Response:** See response to comment 4.06.51.

**8.01.43 BLF Comment:** Page 99. How do we know that the state and Dare County, will be able to come up with the huge amount of money discussed in this page?

What commitments have been given, and are those commitments reasonable?

**Corps Response:** The non-Federal sponsor (Dare County) is fully aware of their financial commitment as expressed in their letter of intent to sponsor and provide the non-Federal share of project costs. Their financial plan, which is part of the Project Cooperation Agreement package, identifies the financial resources that they will utilize to pay for their share of the project for the 50-year project life. Execution of the PCA will be the contractual agreement between Dare County and the Federal Government to construct and maintain the project for 50 years.

**8.01.44 BLF Comment:** Page 5-22. We have been told that piping plovers have nested successfully in the vicinity of Oregon Inlet.

**Corps Response:** This is correct. Piping plovers have nested on the Pea Island National Wildlife Refuge side of the inlet since 1998. The report has been revised to reflect this correction.

**8.01.45 BLF Comment:** Page 6-2. The proposal does not fully review cumulative effects. By breaking the projects down into annual amounts (average miles per year), this underestimates the total amount of miles that are effected. In addition, the Corps neglects to include ocean sand mining and beach disposal projects outside of North Carolina, and the Corps also does not include other coastal engineering projects (groins, jetties, etc.) from other states.

**Corps Response:** We appreciate your concern about the cumulative impacts of projects that may be impacting the Nation's shorelines. We have revised our cumulative impact analysis to more accurately portray the incremental contribution of the proposed project. Please see Section 6.11 of the Final EIS.

**8.01.46 BLF Comment:** We are very concerned that the document does not include a biological opinion ("BO"). As the proposed action may affect listed species, section 7 of the Endangered Species Act requires the Corps to enter into formal consultation with the U. S. Fish and Wildlife Service and the National Marine Fisheries Service. We are concerned that the lack of inclusion of a draft BO is yet another example of the Corps rushing to complete the EIS/Feasibility Report without adequate analysis.

**Corps Response:** Since the draft EIS is serving as the Corps' Biological Assessment of the proposed project, the NMFS and USFWS could not provide a B.O. prior to its issuance. During the comment period, the NMFS has provided their B.O. Unfortunately, the USFWS will be unable to provide its B.O. prior to issuance of the Final EIS. It will be received and considered before preparation of the Record of Decision and all Reasonable and Prudent Measures will be incorporated into the project plan. We do not believe that analysis of endangered species issues is being rushed. The Corps has been working similar endangered species issues on other

beaches throughout the state and country for many years and there are no exceptional circumstances in this project area; therefore, we have no reason to believe that standard conservation measures would not be appropriate.

**8.01.47 BLF Comment:** We emphasize that the Corps should not interpret our lack of comment on a particular issue as an indication that we agree with the statement that the Corps made in the document. Due to the inadequate comment period, we have not been able to review properly the three volume feasibility report/DEIS. We continue to object strongly to the Corps' decision not to provide the BLF with an extension on the comment period, and we are very concerned that this project is being rushed through without sufficient review.

**Corps Response:** See response to comment 4.06.122. This comment letter was received on September 12, 2000, and has been fully considered.

**8.01.48 BLF Comment:** Please place the BLF on the mailing lists to receive a complete copy (all volumes) of the final feasibility report/EIS and the record of decision.

**Corps Response:** BLF has been added to the mailing list.

#### **8.02 Sierra Club (SC), letter dated August 28, 2000**

**8.02.1 SC Comment:** We request a month long extension on the public comment period for the Dare County Beaches Draft Environmental Impact Statement/Feasibility Report. The existing comment period is clearly not sufficient for a review of this massive three-volume report and without additional time; we are unable to adequately review, and provide meaningful comments.

**Corps Response:** See response to comment 4.06.122.

**8.02.2 SC Comment:** Significant concerns that we have on this proposal include - but are not limited too - fisheries impacts (including all multi-state and federally managed species); essential fish habitat impacts; threatened and endangered species impacts; project economics; project changes in marine & terrestrial geology, direct to cumulative, impacts for all recent past to future foreseeable activities; adverse impacts to the general ecology of the region; and time of year for project engagement.

**Corps Response:** Noted. Many sections dealing with these issues have been revised or rewritten. Hopefully, specific areas of concern to you have been addressed to your satisfaction.

**8.02.3 SC Comment:** It is our understanding that other conservation organizations as well as regulatory agencies are also concerned about the adequacy of time for public review. Therefore we again wish to request that a 30 day extension be

granted and also ask your office to immediately send the DEIS 3 volume set to our Special Projects Director Michael D'Amico for his review (address listed below).

**Corps Response:** See response to comment 4.06.122, above.

**8.02.4 SC Comment:** DRAFT Feasibility Report And Environmental impact Statement On Hurricane Protection And Beach Erosion Control - DARE COUNTY BEACHES (BODIE ISLAND PORTION) - Dare County, North Carolina, Volume I - June 2000. Vincent Bellis, Chapter Chair, North Carolina Chapter, SIERRA CLUB September, 2000.

#### Introduction

My first reaction upon receiving the DFR&EIS was a flashback to 1953. That was the year my Dad and I drove from Asheville for a camping trip to the Outer Banks. Highway 12 had just been extended and for the first time a paved road connected Nags Head to Cape Hatteras via a ferry crossing at Oregon Inlet.

I was 15 years old, and since the NC Highway Patrol did not operate south of Oregon Inlet, Dad let me drive. The contrast between crooked two-lane mountain roads and this long ribbon of flat highway was striking. I remember miles of telephone poles fading into the horizon. There was virtually no commercial development along the shoreline. The vegetation between the ocean and the sound consisted largely of grasses and low shrubs. Trees were sparse. But, it was the snow fences that really attracted my attention. They seemed so out of place! Previously I had seen the red wire and wood fences only along roads and fields during the winter in the Finger Lakes country of western New York where I lived as a young child. What were snow fences doing here in the south, on the beach?

I will not here review the saga, and ultimate failure, of attempts to "save" the outer banks by using snow fences to build a sand berm along the ocean. You may now understand why I thought, "Don't they ever learn?", when I read the public notice describing a *"plan of improvement (that) consists of a sand dune constructed to an elevation of 13 feet above the National Geodetic Vertical Datum (NGVD), fronted by a 50-foot wide beach berm constructed to an elevation of 7 feet above NG VD.*

Some of those snow fences appeared again in the 1970's. This time their sunbleached and broken remains emerged from the frontal dunes in places where the rising ocean and narrowing beach had undercut them as the ocean reclaimed its stolen sand. The earlier attempt to 'save' the Outer Banks used ingenuity and wind power to build a sea wall of sand. The proposed project will be much more expensive as it depends upon energy from fuel to pump sand from near shore benthic environments to the beach. More fuel will be consumed as heavy earth moving equipment shapes the sand to engineered specification.

**Corps Response:** Noted.

**8.02.5 SC Comment:** Project Cost - Most of the economic justification for the proposed sand pumping plan seems to be derived from projections of shoreline position over a projected 50-year lifetime of the project. Much of the benefit is tied to "Hurricane and Storm Damage Reduction" (Table 3). The benefit seems to be derived from preventing loss of structures and the income that would be derived from them. The costs of the project are about \$70 million (first cost) with expected annual costs of about \$18million. Spread over the 78 thousand linear feet of the project this works out to about \$1100 per linear foot (almost \$6 million per mile) for initial construction.

The relatively low benefit-cost ration of 1.2 for the north project (Kill Devil Hills/Kitty Hawk) is off-set by a benefit-cost ratio of 2.1 for the south project (Nags Head). Overall benefit-cost ratio is estimated at a modest 1.8.

It might be interesting to consider a response plan that invests these same funds in a long term phased 'strategic withdrawal' from the ocean beach and use of the resulting open space for recreation and to enhance the visitor access and enjoyment of the beach.

**Corps Response:** The comment contains several misconceptions. First, benefits are not included for lost income from properties. This is considered a regional benefit and is not claimed as a benefit to this project. Second, the comment states that, "Spread over the 78 thousand linear feet of the project this works out to about \$1100 per linear foot (almost \$6 million per mile) for initial construction." The comment apparently adds initial costs to annual maintenance to arrive at this number. This is not correct. As for a comparison to non-structural plans, see section 3.3.2, Appendix H, for revised language on non-structural plans. For a discussion of phased withdrawal, see response to comment 4.06.38.

**8.02.6 SC Comment:** Critique of this DEIS -The DEIS (p.9) states that, "The Federal Objective in water resources planning is to contribute to the National Economic Development in a manner consistent with protection of the nation's environment." Basically this project is a political directive (?) from Congress to the US Army Corps of Engineers to find the least expensive means of reducing the immediate storm threat to beachfront structures within the designated area. An added caveat is that the project must meet a benefit/cost ratio exceeding 1.0.

**Corps Response:** The feasibility study was conducted pursuant to a congressional resolution pertaining to Dare County beaches. The primary study emphasis was directed toward shore protection measures at Nags Head, Kill Devil Hills, and Kitty Hawk. The text of the authorizing resolution is: "Resolution adopted 1 August 1990 by the United States House of Representatives. Resolved by the Committee on Public Works and Transportation of the United States House of Representatives, That the Secretary of the Army, in accordance with section 110 of the River and Harbor Act of 1962, is requested to make, under the direction of the Chief of

Engineers, studies of the Dare County beaches, Dare County, North Carolina, in the interest of beach erosion control, hurricane protection, storm damage reduction needs, and related purposes." Principles and Guidelines require that the Corps' formulate alternative measures and evaluate these measures to determine if any of the plans evaluated are economically feasible, i.e., benefit-cost ratio is greater than 1.0 and environmentally acceptable. If plans are feasible and acceptable, the National Economic Development (NED) plan is identified. The NED plan is the plan that maximizes net average annual benefits and is the plan that is recommended by the Federal Government. If the local sponsor elects to pursue another plan (Locally Preferred Plan), it must be economically feasible. If the plan costs less than the NED plan, cost sharing percentages are unchanged. If the plan costs more than the NED plan, the local sponsor has to pay 100 percent of the additional cost.

**8.02.7 SC Comment: DEIS Does Not Adequately Consider Long term Effect of Rising Sea-Level.** In our opinion Congress should have first asked the Corps of Engineers to establish the **long-term** feasibility and potential for indirect environmental impacts before simply finding the most cost effective way to build a protective barrier. The favorable benefit/cost ratio for this project was achieved by estimating the cost of replacing existing development and infrastructure resulting from storm damage. It is our opinion that future costs resulting from probable changes to the stability of the shoreline and near shore sediments in areas adjacent to, but not included within the project, were not adequately accounted for. Completion of the project may lead to a false sense of security among individuals within the affected zone. This could lead to even greater investment in development and infrastructure that must eventually be lost as the cost of future attempts to stabilize a fundamentally unstable beach becomes untenable.

Given past experience with sand berms and artificial dunes together with the documented rising sea level, it seems reasonable to expect the need for beach replenishment to become increasingly frequent as normal erosion removes beach from areas not included in the nourishment program. It seems equally probable that the gradient of the near shore in front of the artificial beach will become increasingly steep. A steeper gradient will require a greater volume of nourishment sand with each new beach re-nourishment (every three years?). The long-term effects on near shore sand supply caused by frequent removal for beach replenishment are not well understood. Barrier Island over-wash has been seriously hindered for over a half century because of various attempts to protect beachfront infrastructure. Sand that might have accumulated on the barrier beaches may have bypassed and resulted in a massive sand deficit within the near shore environment. The long term wisdom of adding to this deficit by removing sand for beach replenishment is questionable. Attempts to 'buy time' for beachfront structures with projects such as those proposed here may well result in massive future economic costs when it becomes too expensive to defend a few miles of beach from inevitable encroachment.

**Corps Response:** See response to comments 4.05.7, 4.06.32, and 9.07.3 regarding the performance of the Wrightsville Beach and Carolina Beach projects. Also, see

response to comment 4.06.103. The Wrightsville Beach and Carolina Beach projects have been successfully maintained for over 35 years. During this time, sea level has apparently continued to rise. The historic shoreline change data used to develop project performance expectations and periodic nourishment requirements implicitly includes the effects of sea level rise that has been occurring since the 1940's. While sea level rise is predicted by some to be accelerating, any increase in the rate of sea level rise will only affect the component of shoreline change associated with this factor. In this regard, the present rate of sea level rise is probably responsible for 1 to 2 feet/year of shoreline recession.

**8.02.8 SC Comment: DEIS Does Not Adequately Address Concerns Expressed by Coastal Scientists.** This DEIS does not adequately allay concerns expressed by coastal geologists (Dolan, Appendix C) and biologists that repeated replenishment events may permanently alter biological communities in the sub-tidal zone and on the beach due to changes in structure of the maritime food chain. Fisheries biologists have expressed concern that turbidity resulting from the winnowing of 'fines' from the replenishment sediment may harm larval fish and shellfish.

**Corps Response:** With the new and revised text provided in this Final EIS, the Corps believes it has adequately described the resources of the project area and the projected impacts to them from the proposed action. Unfortunately, it will not always be possible to provide the level of detailed desired by every reviewer. On balance, after reviewing the impacts to specific resources and the cumulative impacts of the action, we still do not believe the impacts are of such a magnitude as to preclude implementation of the proposed project.

**8.02.9 SC Comment: Completed Project May Instill Undue Confidence Among Residents.** Although The dune and berm may offer temporary protection for structures and infrastructure it is unlikely to be effective against a major hurricane have a storm surge approaching 20 feet (Hurricane Hugo). There is a reasonable probability that such a storm will strike the Date beaches within the 50-year plan projections. The general public and landowners in the area are unlikely to become aware of disclaimers within the DEIS that this project, if completed, will lead to only a measure of protection. It is misleading to allow landowners and taxpayers to believe that the proposed project will protect them and their investments against a major storm. How many members of the public will be able to translate the following example of 'agency speak' (p 8-1) in response to the USFWS request that the "EIS should define the level of storm for which protection is sought; the type(s) of storm damage that would be reduced; and those locations within the project area for which protection is sought.

**Corps Response:** Beach nourishment projects are no longer formulated according to meeting a desired level of protection. Rather, the project dimensions are optimized based on the project size yielding the largest net benefits. Using the 50-year life cycle approach, the beaches are subjected to a randomly generated group



of storms, The project dimension yielding the biggest spread between benefits and costs is the NED Plan. Residual damages exist with the project in place, as shown on page 75 of the main report and on page H-29, section 4.9.

**8.02.10 SC Comment:** Another Alternative. It might be better to accept the inevitable loss of beach and to use the millions of dollars that would be spent on an ultimately futile and increasingly expensive project to 'hold-the-line' to begin a planned and orderly 'strategic withdrawal'. Highway 12 has been relocated land ward many times since my first visit in 1953. Begin now to relocate section of highway away from the beachfront. Highway 158 has long since replaced Highway 12 as the major route through the area.

Knowledge that public funds for 'beach protection' will be used instead to encourage an orderly retreat will encourage those having an economic interest to modify their growth planning so as to reduce the threat of storm loss,

It is a major failing of this DEIS that a 'strategic withdrawal' alternative was not even considered. We agree with the USFWS criticism (p. vi, Executive Summary) that: "The selection among alternatives appears to be confused by the degree to which purposes of storm damage reduction have been intertwined with the unstated goal of erosion control/beach nourishment".

The DEIS does give brief attention to "Nonstructural" measures. The primary 'nonstructural' option considered feasible for this location was structure relocation. This option was not considered to be 'practical alternative'. The DEIS then states that; "Therefore, plan formulation was limited to consideration of beach berm and berm and dune alternatives."

While we can agree that a program of rapid relocation might be impractical and very expensive, we believe that a slower, or phased, plan of strategic withdrawal might be possible and that such an alternative should be evaluated. Phased strategic withdrawal would take place as structures became obsolete, severely damaged by storms, or when there was a willing seller. Unlike the relocation alternative noted in the DEIS, phased strategic withdrawal would take place over the lifetime of the project and thus spread the cost more evenly over time.

**Corps Response:** See response to comment 4.06.38.

**8.02.11 SC Comment:** The NC Chapter of the Sierra Club strongly endorses the measures described in Appendices F and G by which State Governments and Local Governments can reduce the damage caused by shoreline recession (Skidaway Institute of Oceanography 1985). A plan to implement appropriate measures described in these appendices could result in a phased strategic withdrawal from the danger area. Some of these measures are already being used in North Carolina and in other coastal states. These measures can serve as a menu from which to

develop a site specific 'strategic withdrawal'. [We will not reproduce the list of measures here as they are readily available in the DEIS Appendices listed above.]

**Corps Response:** See response to comment 4.06.38.

**8.02.12 SC Comment: Summary** - The berm and dune alternative preferred by the US Army Corps of Engineers does not adequately consider long term geological trends within the project environment. It does not adequately evaluate or monitor possible indirect geological and biological consequences of repeated beach nourishment. The preferred alternative does not spell out explicitly the level of protection offered by the project. Many residents of the affected area may act according to unrealistic expectations of security.

**Corps Response:** The report section (6.11) dealing with cumulative impacts of the project has been revised and plans for monitoring of the project will be developed during PED. Beach nourishment projects are no longer formulated according to meeting a desired level of protection. Rather, the project dimensions are optimized based on the project size yielding the largest net benefits. Using the 50-year life cycle approach, the beaches are subjected to a randomly generated group of storms. The project dimension yielding the biggest spread between benefits and costs is the NED Plan. Residual damages exist with the project in place, as shown on page 75 of the main report and on page H-29, section 4.9.

**8.03 Southern Environmental Law Center (SELC) on behalf of the North Carolina Coastal Federation, letter dated August 28, 2000.**

**8.03.1 SELC Comment:** This letter, written on behalf of the North Carolina Coastal Federation, provides comments regarding the Feasibility Report and Draft Environmental Impact Statement ("FR/DEIS") for a Hurricane Protection and Beach Erosion Control project on the Bodie Island portion of Dare County, North Carolina. The North Carolina Coastal Federation ("NCCF") and the Southern Environmental Law Center are environmental organizations with a long-standing interest in the North Carolina coast. NCCF represents approximately 5,000 members across coastal North Carolina and participates actively in all facets of regulatory and environmental protection activities affecting the state's coast. NCCF has a long history of environmental advocacy regarding the beachfront of the Outer Banks and other segments of the North Carolina coastline, and appreciates the opportunity to submit these comments.

**Corps Response:** Noted.

**8.03.2 SELC Comment:** By resolution of a Congressional committee, the Corps of Engineers was requested to study beach erosion control, hurricane protection, and storm damage reduction on the beaches of Dare County, North Carolina. The Dare County beaches extend from the community of Sanderling, on the northern Outer Banks, south through the developed areas of Kitty Hawk, Kill Devil Hills and Nags

Head on Bodie Island, and continue south to include the Pea Island National Wildlife Refuge and Cape Hatteras National Seashore on Bodie Island, Pea Island, and Hatteras Island. The FR/DEIS concentrates on a 20-mile-long "primary" study area encompassing the developed beachfront in Nags Head, Kill Devil Hills, and Kitty Hawk. The FR/DEIS does not include the extensive study of the shore protection needs for NC Highway 12, the highway that runs the length of the barrier islands. The Corps, with the North Carolina Department of Transportation ("DOT") as the non-federal partner, is currently studying potential erosion control and shore protection measures for this additional lengthy stretch of Dare County beaches.

**Corps Response:** Noted.

**8.03.3 SELC Comment:** The FR/DEIS selects as the Preferred Alternative a massive, 14.8 mile long dredge and fill project of artificial dune and beach berm. The project would require three years to construct and thereafter would entail perpetual maintenance dredging and filling. Our review of the FR/DEIS reveals that the Corps has not adequately considered alternatives to the project, has not carefully examined direct impacts of the project, has failed to consider cumulative impacts, and therefore has failed to fulfill its obligations under NEPA and the Water Resources and Development Act.

**Corps Response:** Many sections dealing with these issues have been revised or rewritten. Hopefully, specific areas of concern to you have been addressed to your satisfaction. With the new and revised text provided in this Final EIS, the Corps believes it has adequately described the resources of the project area and the projected impacts to them from the proposed action. Unfortunately, it will not always be possible to provide the level of detailed desired by every reviewer. On balance, after reviewing the impacts to specific resources and the cumulative impacts of the action, we still do not believe the impacts are of such a magnitude as to preclude implementation of the proposed project.

**8.03.4 SELC Comment: INADEQUATE CONSIDERATION OF ALTERNATIVES**

The FR/DEIS fails to adequately consider alternatives to the proposed project. This constrained view of alternatives is, in part, the result of the Corps' reliance upon several inaccurate and unjustified assumptions. These assumptions also result in the benefits of the project being overstated and the costs being understated.

First, and foremost, the Corps unjustifiably dismisses non-structural alternatives. In two short paragraphs, the Corps concludes, without analysis or thoughtful discussion, that the only non-structural alternative is to relocate "all the oceanfront structures", an endeavor the Corps estimates would cost \$300 million. A non-structural alternative, however, does not necessarily entail relocation of all of the structures. No assessment is made of the availability of appropriate locations for structure relocation and how many structures could feasibly be relocated. No assessment is made of the alternative of a moderated retreat in which temporary,

small-scale nourishment is used to reduce storm damage hazards in the short term while threatened structures are removed and either relocated or demolished.

Prevailing public policy, and the law of the State of North Carolina, establish a policy of retreat from eroding shorelines through building relocation, building setbacks, development restrictions, and land use planning. 15 N.C.A.C. § 7H.0202(b), 7H.0306, 7H.0308. The primary purpose of the project is storm damage prevention and hazard reduction, not saving or relocating all existing structures. A genuine and open-minded analysis of alternatives must evaluate thoroughly the costs and benefits of a range of combinations of selective relocation, demolition, and temporary nourishment.

A companion assumption that drives the Corps' analysis, but has no basis in fact, is that if the project is not constructed, the beach in front of existing structures will be hardened as property owners and communities take drastic shoreline protection steps. The FR/DEIS assumes that the beach will be lost if not nourished because shore protection structures, such as sandbags, will be installed and the beach will erode to those structures. Hardening of the beach, however, is prohibited under the North Carolina Coastal Area Management Act. While some communities have obtained permits for temporary placement of sandbags, long-term use of sandbags is not permitted and permanent erosion control structures are banned. 15 N.C.A.C. § 7H.0808(a)(1)(B); .0308(a)(2)(F).

The assumption that the beach will disappear unless the project is built also ignores the elemental facts of the natural processes of barrier island migration. The island will continue to have a beach unless constrained by artificial hardening. The beach itself does not need to be protected from erosion and will not disappear unless hardened erosion control structures are allowed. Instead, buildings threatened by erosion will disappear as the beach moves landward. The Corps' selection of a massive structural alternative based on the fact that "it is primarily the beach that draws visitors to the area" contributes nothing to the analysis, for the beach will remain.

Because the FR/DEIS has not examined combinations of non-structural strategies of retreat, relocation, demolition, and temporary, short-term beach nourishment, the Corps has failed to comply with its duties under NEPA to give the project a "hard look" and to examine carefully all practicable alternatives.

**Corps Response:** The policy and regulations of the North Carolina Division of Coastal Management recognize "replenishment of sand on ocean beaches" as a viable means of providing protection to oceanfront development, and as a potentially "feasible alternative to the loss or massive relocation of oceanfront development." 15 N.C.A.C. Section 7M.0202(c). See responses to comments 4.06.11 and 4.06.38.

#### **8.03.5 SELC Comment: INCOMPLETE EXAMINATION OF DIRECT IMPACTS**

We will not reiterate here the detailed analysis of direct environmental impacts posed by this project which is set out in the Fish and Wildlife Coordination Act Report ("FWCA Report") of the Fish and Wildlife Service (the "Service"), included in the FR/DEIS as Appendix B. We share the Service's concerns and incorporate them by reference into this letter. We wish to highlight several.

The Corps' analysis turns entirely on an assumption that both dredged and filled areas will recover soon after the dredging and filling activity ceases. This conclusion is entirely undermined, however, by the unfortunate fact that neither the dredging nor the filling will cease in the proposed project. The construction of the project spans three years of continuous dredging and filling, followed by 47 years of continual renourishment. The Corps offers no evidence that either the dredged or the filled areas will have an opportunity to recover from the complete wipeout of organisms in the affected areas.

**Corps Response:** Recovery of beach fauna will be an ongoing process. However, as noted in your comment, agencies suggest the possibility that recovery will never be fully completed in the project area because of the frequency of disturbance events. This theory is somewhat speculative and its significance is, therefore, uncertain. Almost every natural community on the landscape today is in a state of recovery, and few will ever achieve it before another disturbance event, such as logging, fires, or hurricanes, will impact them again. What is important is whether or not the ecological community fulfills the needs of the significant resources that depend on it. At other beaches in the state that are nourished with similar frequency as that being proposed here, significant resources such as shorebirds, surf zone fishes, and mole crabs can still be found in abundance. Monitoring proposed at the Dare County beaches project area would assess both recovery rates and impacts on significant resources.

**8.03.6 SELC Comment:** In addition, any forecast concerning the actual amount of continuous dredging and filling needed to maintain the project over its 50-year lifespan is entirely speculative. Neither engineering experience nor computer models can predict the erosion rates on as active and varied a shoreline as this study area. Storm patterns, and storm impacts, are highly unpredictable. Changes caused by the project itself are unpredictable, and studies elsewhere have shown greatly accelerated beach erosion rates caused by nourishment projects. (See sources cited at pp. 98-100 of FWCA Report). This uncertainty is exacerbated by the finding, documented by Dr. Dolan in the FWCA Report, of an inappropriately high percentage of fine sediment particles in the proposed borrow areas.

**Corps Response:** The plan formulation procedure used for the Dare County beaches project considered the random nature of storm events and the variable nature of shoreline behavior by employing a life cycle model. The prediction of future changes in the shoreline were based on erosion rates determined by the

North Carolina Division of Coastal Management (NCDCM) from the comparison of shoreline positions interpreted from aerial photographs taken between 1940 and 1992. This model, named GRANDUC, simulated 500 50-year life cycles. During each of the 50-year life cycles, storm occurrences were randomly selected which resulted in variable shoreline changes during each of the 50-year simulations. However, shoreline changes at the end of each 50-year simulation generally matched the long-term changes represented by the NCDCM data. Based on these simulations and simulations shoreline response developed from the application of a model known as GENESIS, shoreline changes and nourishment requirements for the project were found to be approximately two-times greater than changes experienced by the natural beach.

With regard to the compatibility of the borrow material with the native beach sands, Dr. Dolan prepared his report and made his conclusions based on an incomplete set of data for the native beach material. This incomplete data set only included the coarser foreshore material collected from the toe of the natural dune seaward to mean low water. Beach nourishment projects must provide material to nourish the entire active beach profile, which, for the immediate study area, extends to water depths of approximately 25 feet below NGVD. Native beach sands in the area located seaward of mean low water have relatively small median grain sizes. When the offshore material characteristics are combined with the near shore sediments, the resulting composite grain size for the native sands agree well with the composite characteristics of the borrow material. An analysis of the compatibility of the borrow area sands with the native beach sands is provided in the feasibility study. This complete analysis shows that the borrow material is compatible with the native beach material. Dr. Dolan has been provided a complete data set for the native beach material.

**8.03.7 SELC Comment:** The FWCA Report identifies a number of direct impacts related to the dredging and filling activity which are underestimated in the FR/DEIS because of the unjustified assumption that the activity will cease. Turbidity impacts, destruction of organisms in the areas to be dredged and filled, and the impacts of conducting the dredging and filling activities during the biologically productive spring, summer and fall months, are outlined in the FCWA Report. These impacts also mean that the project will violate North Carolina law prohibiting shoreline erosion response projects in areas that sustain substantial habitat for important fish and wildlife species without adequate mitigation, because the many mitigation suggestions in the FWCA Report have not been incorporated into the project. See 15A N.C.A.C. § 7H.0308(a)(1)(E).

**Corps Response:** 15A N.C.A.C. Section 7H.0308(a)(1)(E) provides that "shoreline erosion response projects shall not be constructed in beach or estuarine areas that sustain substantial habitat for important fish and wildlife species unless adequate mitigation measures are incorporated into project design, as set forth in Rule .0306(i) of this Section." Rule .0306(i) requires that proposals shall "incorporate all reasonable means and methods to avoid or minimize adverse

impacts of the project.” Measures may include actions that either minimize or avoid, restore, or compensate by replacing or providing substitute resources.”

Impacts on beach and dune and nearshore ocean communities are discussed in Sections 6.01 and 6.04 of the FEIS. The environmental commitments Section 6.11.1 are included in the plan to minimize impacts on these resources. Proper monitoring as described in Section 6.11.2 of the FEIS will be implemented.

**8.03.8 SELC Comment:** The Corps' analysis also neglects the near certainty that substantial quantities of the project material will drift south into nearby Oregon Inlet, contributing to shoaling in that inlet, and thereby potentially exacerbating inlet migration to the south and pressure both on the North Carolina DOT terminal groin at the northern end of Pea Island and the southern terminus of the Bonner Bridge. Project sand migration into Oregon Inlet will increase the maintenance dredging required in that area to maintain the navigation channel, adding substantial costs attributable to the project.

**Corps Response:** See response to USFWS comments 4.06.51 and 4.06.52. Sediment transport to the south toward Oregon Inlet is predicted to increase linearly from zero in the first few years following construction of the storm damage reduction project to around 13 percent at the end of the 50-year project life. Of the increased volume of sediment transported to the inlet, only a relatively small percentage is expected to actually shoal the channel. For example, the existing navigation channel captures approximately 25 percent of the gross littoral drift moving toward the inlet. Note that gross drift is the sum of material moving along the shoreline in both the north and south directions. Assuming that the additional sand arriving at the inlet from the nourishment project shoals the channel by the same percentage, shoaling of the Oregon Inlet navigation channel would only increase by a maximum of 3 to 4 percent by the end of the 50-year project life. However, shoaling would be much less than this during the majority of the 50-year period. Generally, shoaling increases of this magnitude are not discernible as the volume lies within the error band associated with the survey data. Accordingly, the Dare County project would not have a measurable impact on shoaling of the Oregon Inlet ocean bar channel or the migratory tendencies of the inlet.

**8.03.9 SELC Comment:** Finally, the FR/DEIS does not acknowledge that the project will inexorably lead to increased beachfront development landward of the project. Increased development will only lead to increased, not decreased, storm damage in the future, directly contrary to the allocation of costs and benefits in the FR/DEIS.

**Corps Response:** See response to comment 4.06.10.

#### **8.03.10 SELC Comment: FAILURE TO CONSIDER CUMULATIVE IMPACTS**

The FR/DEIS gives even shorter shrift to cumulative impacts than it does to other aspects of the analysis. NEPA requires that the cumulative effects of this project be

analyzed along with the effects of existing and potential projects. Cumulative impacts "can result from individually minor but collectively significant actions taking place over a period of time." 40 C.F.R. § 1508.7. The FR/DEIS at Section 6.01.2 and Table 6-1, purports to quantify the "general impacts" of beach disposal on other North Carolina beaches but this presentation both completely misrepresents the amount of North Carolina oceanfront already affected and potentially affected by disposal activities, and completely fails to offer any analysis of the cumulative impacts.

To conduct a valid cumulative impacts analysis, the Corps must look at not only the ongoing and potential projects listed in Table 6- 1, but at all other North Carolina beachfront sand disposal activities. In its 30-year economic forecast, the Corps includes four more proposed major nourishment projects not counted in the cumulative impacts figures: Topsail Beach, Bogue Banks in three phases, Surf City, and North Topsail Beach. Combined predicted shoreline lengths for these projects would add another 37.5 miles to the length of impacted beach. The projects are tentatively scheduled for construction in 2008 through 2015, pending study and funding, well within the 50-year life of the Dare County project, and should also be considered in the cumulative count of shoreline affected.

**Corps Response:** We appreciate your concern about the cumulative impacts of projects that may be impacting the state's shorelines. We have revised our cumulative impact analysis to more accurately portray the incremental contribution of the proposed project. Please see Section 6.11 of the Final EIS.

**8.03.11 SELC Comment:** Other current and proposed projects which need to be considered by the Corps in addition to the projects in Table 6-1 are:

<u>PROJECT</u>	<u>AGENCY</u>	<u>TYPE OF PROJECT</u>	<u>STATUS</u>	<u>LENGTH</u>
Topsail Beach	Corps of Engineers	Nourishment	Proposed	5.5 miles
Bogue Banks (three phases)	Corps of Engineers	Nourishment	Proposed	17 miles
Surf City	Corps of Engineers	Nourishment	Proposed	5 miles
North Topsail Beach	Corps of Engineers	Nourishment	Proposed	10 miles
Wilmington Harbor – Bald Head Island	Corps of Engineers	Spoil disposal	Current	1 additional mile
Wilmington Harbor – Caswell Beach/Oak Island	Corps of Engineers	Spoil disposal	Current	9.6 miles
Wilmington Harbor – Holden Beach	Corps of Engineers	Spoil disposal	Current	2 miles
Atlantic Intracoastal Waterway	Corps of Engineers	Expanded channel dredging with spoil disposal	Proposed	From Virginia to South Carolina state line



(continued from previous page)				
<b>PROJECT</b>	<b>AGENCY</b>	<b>TYPE OF PROJECT</b>	<b>STATUS</b>	<b>LENGTH</b>
Onslow Beach (partially in the CBR System)	Marine Corps at Camp Lejeune	Nourishment	Proposed	1 mile
Mason Inlet Relocation – Figure Eight Island	New Hanover County	Spoil Disposal	Proposed	2 miles
Figure Eight Island	Private	Nourishment	Current	2 miles
Long Beach Sea Turtle Restoration Project	Corps of Engineers	Nourishment	Proposed	2.3 miles
Lockwoods Folly River Environmental Restoration	Corps of Engineers	Possible dredging and disposal	Proposed	Unknown
			<b>TOTAL</b>	<b>59.4 miles known</b>

Adding these figures to those in the FR/DEIS yields an estimated total of 136 miles-of shoreline slated for sand disposal, almost double the 76.7 miles in Table 6-1. The total is now close to 43% of the entire North Carolina coastline.

**Corps Response:** Your figure includes double counting of beaches that are used for both disposal and proposed for nourishment. This information was considered in revising the cumulative impact section 6.11 of the FEIS.

**8.03.12 SELC Comment:** It is important to note also that this total does not include the new Atlantic Intracoastal Waterway project length which may place new sand disposal on numerous beaches up and down the entire length of the coast, according to a August 3, 2000 public notice.<sup>1</sup>

**Corps Response:** No modifications in project length are anticipated, considered, or proposed for the Atlantic Intracoastal Waterway (AIWW) in North Carolina. Also, there has been no public notice to that effect. There was an interagency scoping meeting held on August 3, 2000 to invite participation in the development of a Dredged Material Management Plan (DMMP) for the AIWW in North Carolina. As explained at that meeting, the DMMP will evaluate dredged material disposal needs

<sup>1</sup> The disposal projects in the FR/DEIS Table 6-1 are given as a total sum and are not catalogued. In order to attempt a determination of which projects were not used in the Corps' analysis, a study of other Corps' documents, including a chart of project lengths which corresponds to the list in the FR/DEIS, as well as information from the Fish and Wildlife Service and other sources were used. The status or length of projects may have changed or may change in the future due to the unpredictability of study and funding of the projects.

of the AIWW over the next 20 years and lay out a plan to accomplish the needed maintenance dredging in the least costly manner that is consistent with sound engineering practice and that meets all Federal environmental standards. This will constitute the "Base Disposal Plan." The development of the DMMP is required by regulations (ER 1105-2-100) of the US Army Corps of Engineers (USACE) to identify and evaluate an array of potential disposal alternatives, including the beneficial use of dredged material. Beneficial uses may include measures such as utilization of beaches for the disposal of beach quality sand. Such beneficial uses will be fully explored as DMMP studies progress.

In North Carolina, the AIWW is in sufficient proximity to the Atlantic coastline that beach disposal could be a potential option south of Beaufort, which is approximately 137 waterway miles from the South Carolina state line. North of Beaufort, the AIWW extends inland away from the coast for its 171-mile length, and beach disposal would not be a viable alternative.

**8.03.13 SELC Comment:** In addition, the amount of sand disposal activity may well increase to keep pace with the large-scale cycle of nourishment which the Corps, the State, and the coastal counties propose to put in place over the next 15 years. Additional miles should be added in any cumulative impacts analysis to account for such unknown projects, and for scheduled projects which run over the Corps' estimated count.

**Corps Response:** See response to comment 8.03.10.

**8.03.14 SELC Comment:** The Corps should consider not only the length of projects, but also the huge amount and frequency of sand placement. Smaller, more frequent nourishments are reported to be more benign for aquatic and shore communities, and may last longer, as demonstrated by the experience of Virginia Beach. Instead, the Corps tends to increase both the amount of sand disposal, and the project length for dredging and disposal projects. For example, Manteo Shallowbag Bay (Oregon Inlet navigation dredging) was previously recorded as a 300,000 cubic yard annual disposal project on 1.5 to 3 miles length of shore. In a public notice dated April 10, 2000, the project was upgraded to a 350,000 cubic yard disposal amount on 2.6 to 3.4 miles of shore. The Corps may also largely increase its spoil disposal amounts on beaches as it develops its 20-year AIWW Dredge Material Management Plan.

**Corps Response:** Federal navigation projects have specific dimensions which are set by their authorizing documents and which remain constant until such time as their authorizations are modified through acts of Congress or specific authorities delegated to the Chief of Engineers. However, natural accumulation of sediment in the channels and harbors of these projects reduces their effective dimensions and impairs safe, predictable, and economic navigation. Therefore, maintenance dredging must be accomplished periodically in order to remove the shoals and restore the dimensions. Amounts of shoal material vary from year to year in

response to the forces of nature, so dredging and disposal quantities will vary likewise.

Beach quality sand is a valuable resource which is highly sought by beach communities to provide wide beaches for recreation and tourism, as well as to provide hurricane and wave protection for public and private property in these communities. When beach quality sand is dredged from navigation projects, it has become common practice of the USACE to make this resource available to beach communities, to the maximum extent practicable. Placement of this sand on beaches merely represents return of material which eroded from these beaches, and is, therefore, replenishment with native material. The design of beach placement sites is very simple, generally starting at the high tide line and proceeding seaward, with a crest elevation approximately equal to mean high water. Widths of beach placement zones generally reflect the wishes of the local government relative to the choice between a long, narrow beach or a shorter, wider beach.

Beach disposal of dredged beach quality sand follows the policy of the State of North Carolina, which makes it no longer acceptable to remove sand from the active littoral system by ocean disposal or permanent placement in diked disposal areas when other cost-efficient and environmentally acceptable options are available. The North Carolina Coastal Management Program now requires that clean, beach-quality sand dredged from navigation channels in the coastal area not be removed permanently from the active nearshore, beach, or inlet shoal system, unless no practicable alternative exists (NC Administrative Code T15A: 07M.1102). The USACE recognizes that this policy is not without controversy, however, because intertidal macroinvertebrate populations, shorebirds, and nesting sea turtles utilize beach habitat and may be subject to adverse impacts from placement of dredged material during warmer months of the year. In the interest of protecting these resources, beach disposal is scheduled for accomplishment during the cooler months of the year, to the maximum extent practicable. In cases where this schedule cannot be met, other protective measures are implemented for the protection of sea turtles and nesting birds.

In planning for the cost-effective maintenance of Federal navigation projects, the USACE continually seeks improved methods for dredging and disposal. Attention is now being focused on evaluating the feasibility of using existing dredged material disposal islands as recycling sites for beach quality sand. This approach would involve the removal of previously dredged beach quality sand from the interior of island disposal sites located along existing navigation projects, including the AIWW and Wilmington Harbor. The material would be relocated by dredging and placement on a nearby beach. The emptied disposal site would then become available for subsequent maintenance dredging and disposal events until it becomes full again. Its contents would then be recycled to the beach and the process would continue. It appears that this procedure would offer a number of advantages. These include the following:

- Short-term cost savings could likely be obtained because beach disposal sites are generally much further from the dredging site than the island disposal sites. Therefore, beach disposal events usually require a higher mobilization and demobilization cost for a disposal event because much longer dredge pipes, as well as heavy equipment must be delivered, set up, and removed. In addition, the cost of pumping material through a hydraulic dredge plant increases as the distance increases. Using nearby island disposal sites for frequent small-scale dredging saves costs in both respects.
- Beach communities could still receive the beneficial use of dredged sand, but it would be placed during a larger scale disposal event that would occur on a less frequent basis.
- Beach biota would be subject to less frequent disturbance, and periods for recovery would be much longer. This could reduce the potential for long-term population impacts on intertidal invertebrates.

Since public demand, as well as state laws and policies, support continued use of dredged sand for beach replenishment, it is likely that the USACE navigation dredging program will continue to make this sand available to beach communities, and it is possible that quantities could increase. However, it is also possible that methods will be implemented to reduce the frequency of beach disposal events, even if quantities increase, as discussed above. In addition, it is possible to modify the length and width of beach disposal sites in accordance with changes in governmental policies and guidance. In any case, continued utilization of sand produced through the navigation mission of the USACE to address needs that are consistent with its shore protection mission will provide benefits to both programs as well as to the US taxpayer.

**8.03.15 SELC Comment:** In view of the massive amount of historic, current and proposed beachfront sand disposal, the Corps must completely redo its cumulative impact analysis. In doing so, the Corps must actually analyze, not just quantify, the impacts of beachfront sand disposal on this scale. As recently held in Friends of the Earth, Inc. v. United States Army Corps of Engineers, \_\_\_ F.Supp. 2d. Civil Action No. 98-2439 (PLF)(D.D.C. August 10, 2000), a Corps' cumulative impact discussion that contains absolutely no "actual analysis," only the "conclusory statement" that the impacts "have been minimal" does not comply with NEPA. Such "conclusory remarks ... do not equip a decision-maker to make an informed decision about alternative courses of action or a court to review the Secretary's reasoning. NRDC v. Hodel, 865 F.2d. 288, 298, (D.C.Cir.1988)."

For the same reasons, and as an alternative means of performing the cumulative impacts analysis, the Corps should consider performing a programmatic EIS for its North Carolina beachfront sand disposal activities before determining whether to conduct a specific project on Dare County. As the Fish and Wildlife Service points out in the FWCA Report, the current analysis does not address what areas of greatest need and greatest benefit are along the coastline. In addition, the project

is proposed without consideration of the current, legislatively-mandated North Carolina study of North Carolina beach renourishment needs and priorities.<sup>2</sup>

**Corps Response:** See response to comment 8.03.10.

**8.03.16 SELC Comment:** In addition, and for the same reasons, limiting the present study to the Kitty Hawk, Kill Devil Hills and Nags Head portion of the Dare County beaches, and not including the remaining Dare County beaches and the NC Highway 12 study, unlawfully segments this study in violation of NEPA, which requires all connected actions be studied together.

**Corps Response:** CEQ regulations provide that connected actions should be discussed in the same EIS. Actions are connected if they (i) Automatically trigger other actions which may require environmental impact statements; (ii) Cannot or will not proceed unless other actions are taken previously or simultaneously; (iii) Are interdependent parts of a larger action and depend on the larger action for their justification. 40 CFR Section 1508.25(a).

The project described in this report and the study of the remaining portions of Dare County are not connected actions as defined by the CEQ regulations. This project is presented to Congress as an independent project; it is independently justified by the analysis required by Corps planning principles. It will neither cause, nor is it dependent upon the study of the remaining portions of Dare County. It is both permissible under NEPA and prudent to provide the needed shore protection to Kitty Hawk, Kill Devil Hills, and Nags Head as soon as possible, to prevent hurricane and storm damage to these developed areas.

The present study is in the final stages of the feasibility phase; it has been coordinated with the public, the proposed action has been identified, and fully evaluated. The feasibility study for the remaining portions of Dare County has not yet been funded. Once initiated, that feasibility study will take at least three years to complete. During that time frame, if a sufficient Federal interest is found, alternatives will be evaluated and coordinated with the public, a proposed action will be identified. That proposed action may or may not be beach nourishment.

The DEIS identifies potential actions that may result from the study of the remaining portion of Dare County as a part of the cumulative impact analysis. Any study of a

---

<sup>2</sup> NC General Assembly (HB 1840) S.L. 2000-67 § 13.9(c). The General Assembly has instructed DENR to develop a beach management and restoration strategy that, among other directives, "Provides for coordination with the U.S. Army Corps of Engineers, the North Carolina Department of Transportation, the North Carolina Division of Emergency Management, and other State and federal agencies concerned with beach management issue ... Considers the regional context of beach communities to determine the most cost-effective approach to beach nourishment ... Recommends priorities for State funding for beach nourishment projects." The study is due for submission to the General Assembly by May 1, 2001.

potential project generated by a feasibility report for the remainder of Dare County will include relevant analysis of the project discussed by this report.

**8.03.17 SELC Comment:** For these reasons, the Draft FR/EIS should not be finalized in its present form, and substantial additional studies should be performed on analysis, direct impacts and cumulative impacts before a revised draft is published.

**Corps Response:** CEQ regulations provide that a revised draft of a DEIS, or portion thereof, should be prepared when the draft statement is "so inadequate as to preclude meaningful analysis." As discussed above, the DEIS identifies all issues involved in this action, and addresses potential direct and cumulative effects of the proposed project.

We disagree that new studies are needed. We have expanded our discussion of cumulative impacts to further explain our position that the cumulative impacts are not significant. CEQ regulations provide that a revised draft of a DEIS, or portion thereof, should be prepared when the draft statement is "so inadequate as to preclude meaningful analysis." We do not believe this to be the case. The DEIS identified all issues involved in this action, and addressed potential direct and cumulative effects of the proposed project.

## **9.0 INTERESTED BUSINESSES, GROUPS, AND INDIVIDUALS**

### **9.01 The Outer Banks Association of Realtors (OBAR), letter and resolution dated August 8 and July 19, 2000, respectively**

**OBAR Comment:** The OBAR supports the proposed action.

**Corps Response:** Noted.

### **9.02 Marian and William Clough, letter dated August 2, 2000.**

**Clough Comment:** Our family has been visiting the Outer Banks since the early 1960s. We have been home owners since 1986. Thus, three generations of our family believes the beach in North Carolina are the most wonderful place in the world. We had a grandchild who was a victim of leukemia, but her "Make a Wish" was to travel to North Carolina to our little beach house in South Nags Head (she lived in Connecticut) just six weeks prior to her leaving us. The shells she collected are still on an outside bench where she placed them - despite the "Halloween" storm that followed her leaving by two weeks. I expound upon this because this is only one of the very personal reasons why we want to would like to see the beaches preserved.

Of course there are economic reasons that would justify the nourishment of the beaches. The businesses that have sprung up (and those businesses that had existed and have most obviously thrived) would not even exist if the beaches were not attracting the tourists. We live in New Jersey and the number of people who have heard of the "Outer Banks" and now vacation on those wonderful beaches is unbelievable. We are of the opinion that the economy dictates that the beaches be preserved. Thus, we most wholeheartedly support beach nourishment.

**Corps Response:** Noted. We are sorry to hear about the loss of your grandchild but are pleased that her final trip to North Carolina produced such pleasant memories.

**9.03 Stephen and Margaret Burch, letter dated August 1, 2000.**

**Burch Comment:** My wife and I decided some time ago to retire at the Outer Banks of North Carolina. Four years ago that dream became reality as we moved to our cottage, acquired in 1988., on the ocean front in Nags Head. Following purchase, it was necessary to move the cottage back from the ocean. The annual erosion rate for this part of Nags Head, the historic district, is three feet per year. Thus we moved the recommended 90 feet. Instead of being safe for thirty years, we find the ocean crawling ever closer to our home. We might be able to move westward 50 feet but no further. I thus write you in support of beach nourishment. I shall be glad to pay my part as either taxpayer or property owner realizing that the beach is public domain for enjoyment by all. I shall also be glad to help in any other way I can since I am a retired attorney and have the time.

**Corps Response:** Noted.

**9.04 Beverly Perdue Jennings , letter not dated.**

**Jennings Comment:** Ms. Jennings supports the proposed action.

**Corps Response:** Noted.

**9.05 Mrs. R. Bruce MacWhorter, letter dated July 27, 2000.**

**MacWhorter Comment:** We are homeowners in Southern Shores, NC and have been since we built an oceanfront house in 1991. I understand you are interested in receiving material on the possibility of a beach nourishment program. I would like to share our experiences with you. We found that we were losing more and more of our dune as a result of storms, requiring more and more stairs to reach the beach. Then in about 1995 the entire slope on the ocean side had been eradicated and every time there was a high tide we were losing more of the top of the dune because it was falling into the ocean. After talking to some of the local experienced residents we got permission for a "beach push" in March 1995 after organizing 5 or 6 neighbors on both sides who were having similar problems. This "beach push" has really saved us

along with the planting of beach grass. It created a slope from the tidal line up to the dune as well as providing a dune again as we had had four years before. Three years later we decided to have just a little touch up "push" as the permission was expiring and we are now in a position of fighting off the sand as it covers our dune deck and beach stairs a far preferable problem.

This was surprisingly inexpensive compared to the nourishment programs we read about in New Jersey where our main domicile is. Here they are dredging sand and piping it on to the beaches and a good storm wipes it right back into the ocean. I believe the sloping of the beach as a result of the plows pushing 6 inches of sand toward the dune is as important as the building of the dune itself. The important thing is to preserve the dune BEFORE it falls into the ocean.

**Corps Response:** While the experience with beach scraping and dune construction seems to have been successful in this case, there are many more examples where this type of activity and resulted in no net gain in protection. The slope of the beach is controlled by the grain size of the material, wave climate, and tidal conditions. Reshaping the beach slope with mechanical equipment will only change the slope temporarily. Also, using material from the beach immediately in front of the property to construct the dune does not add any new material to the system. Eventually, the system will reclaim the displaced material.

#### **9.06 Mr. and Mrs. Donald J. Hughes, letter dated August 7, 2000**

**Hughes Comment:** The Hughes' support the proposed action.

**Corps Response:** Noted.

#### **9.07 Celeste Wescott Maus, letter dated August 25, 2000**

**9.07.1 Maus Comment:** I noted inconsistencies in and I have major concerns about the following: the process; the predicted cost; the use of a computer-simulated model versus actual available data;

**Corps Response:** All of the elements mentioned in the comment have been explained in detail in the Feasibility Report and EIS, and have undergone a great deal of technical and policy scrutiny within the Corps.

**9.07.2 Maus Comment:** the proposed location of disturbance which is a primary nursery area;

**Corps Response:** No primary nursery areas will be impacted by the proposed action (see Section 6.04.11 of the FEIS).

**9.07.3 Maus Comment:** the effectiveness of the project with the comparison to similar projects that have been unsuccessful along the coastline;



**Corps Response:** There are only 3 active storm damage reduction projects in North Carolina. Two of these projects, Wrightsville Beach and Carolina Beach, have been in existence since 1965. The third was completed in 1998. Both the Wrightsville Beach and Carolina Beach projects have been extremely effective in preventing damages due to coastal storms and long-term erosion. These two projects recently survived the impacts of 5 hurricanes, most notably Hurricane Fran in 1996 which produced high water levels comparable to the previous storm of record, Hurricane Hazel of October 1954. Not only did the two projects survive, they greatly reduced storm damage. Graphic comparisons of the effectiveness of these two projects in preventing storm surge and wave induced damages was evident by the comparison of the damages experienced by neighboring unprotected beaches. A draft report on the differences in the impacts of these storms on the protected and unprotected coastal communities, which was prepared by the Corps of Engineers Institute for Water Resources, was published in June 2000 with the final report scheduled for publication later this year. This report fully documents the protective value provided by the Wrightsville Beach and Carolina Beach projects.

The third project, known as the Kure Beach project, was completed in February 1998. While this project has only been in operation a relatively short time, it has already prevented damages that would have been caused by Hurricane Bonnie in 1998 and Hurricanes Dennis and Floyd in 1999. All three of these projects are considered to be successes.

**9.07.4 Maus Comment:** the effects on the fisheries and other environmental impacts.

**Corps Response:** Sections 5.04 Marine Resources and 6.10 of the FEIS adequately address these issues.

**9.07.5 Maus Comment:** I strongly urge 1) the continuation of the study 2) new proposed solutions 3) public hearings about the matter.

**Corps Response:** As described above, the DEIS adequately addresses the concerns of the commentor which have apparently led her to urge the continuation of the study, and proposed new solutions. With regard to the request for a public hearing, CEQ regulations provide that an agency is to consider as criteria in its decision to hold public hearings :

- (1) Substantial environmental controversy concerning the proposed action or substantial interest in holding the hearing, and
- (2) A request for hearing by another agency with jurisdiction over the action supported by reasons why a hearing will be helpful.

Although the Corps received numerous comments on this DEIS, this is the only request we have received for a public hearing. No reasons why a hearing would be helpful were given, and the Corps does not believe that a public hearing would serve to clarify issues or provide additional information that could not be provided during the public comment period. The Corps has considered the factors required by the regulations, and does not believe a public hearing would serve any valid interest.

**9.08 Gwendolyn S. Wescott, letter dated August 22, 2000**

**9.08.1 Wescott Comment:** Thank you for allowing me an opportunity to review Volume I (where are the other volumes?) I have based my comments as a secondary-level educator, a college educator, and environmentalist, a student of nature, and a tax payer of Dare County and Camden County. Both counties will be changed by the results of this project. I have read, noted, dogeared, and highlighted many statements. Yet, I choose to alert you to a few points.

**Corps Response:** Noted.

**9.08.2 Wescott Comment:** The following items I question: In the introductory section, It appears to be a segmental plan attempting to redesign by humans the coastal landscape of NC.

**Corps Response:** The proposed project is a beach nourishment project formulated to protect upland property from hurricane and storm damages and beach erosion. The proposed project will nourish the natural landscape, which is being eroded by coastal storms, and long term shore processes.

**9.08.3 Wescott Comment:** The authority section suggests political and certain businesses, not environmental, scientific, non-humanitarian reasons.

**Corps Response:** Noted. The authority is as follows: Resolved by the Committee on Public Works and Transportation of the United States House of Representatives, That the Secretary of the Army, in accordance with section 110 of the River and Harbor Act of 1962, is requested to make, under the direction of the Chief of Engineers, studies of the Dare County beaches, Dare County, North Carolina, in the interest of beach erosion control, hurricane protection, storm damage reduction needs, and related purposes. Corps' criteria requires that any plan recommended must be engineeringly feasible, economically feasible, environmentally acceptable and politically acceptable.

**9.08.4 Wescott Comment:** In the scope of study section p.4 – a misnomer appears as it reads "Supplement No.2....to navigation improvements (jetties at Oregon Inlet)" in the complete sentence continuing to Shallowbag Bay".

**Corps Response:** Noted.

**9.08.5 Wescott Comment:** Have commercial fishermen, environmentalists, geologists, and Fish and Wildlife agencies really been contacted?

**Corps Response:** Table 8-1 of the FEIS shows those Federal, State, and local agencies, elected officials, environmental groups, and known interested individuals that were sent copies of the document for their review and comment.

**9.08.6 Wescott Comment:** Listen to geologists from Duke and East Carolina even UNCW (Listen to marine life professionals about habitat).

**Corps Response:** We have and will continue to work with these individuals.

**9.08.7 Wescott Comment:** This project really is a modern lampoon on the “boy emptying the ocean with a bucket” or “Dutch child plugging a hole in the dike.” This proposed project will cost North Carolina taxpayers for over 50 years! This project will have serious ramifications for fowl, fish, turtles and other endangered marine life, and native vegetation.

**Corps Response:** We disagree. Please review the Operation and Maintenance portion of the Feasibility Report. The benefits far outweigh the costs for the proposed action. Additionally, we don’t believe that the proposed action will have a significant impact on the environment.

**9.08.8 Wescott Comment:** Map 14 – Figure 2 illustrated some of the ramifications.

**Corps Response:** Noted.

**9.08.9 Wescott Comment:** The topography of our coast will modify yearly for at least 50 years. (Erosion is a natural process and the modification will not be as dramatic as this proposed human change).

**Corps Response:** In the context of a completely undeveloped beach, this observation is probably true. However, given that the study area beaches are fully developed, changes in the shoreline topography resulting from a continuation of past shoreline trends would be profound. Anthropocentric features, such as damaged houses, eroded roadways, exposed septic tanks, and failed protection efforts (primarily sand bag revetments), would continue to litter the beach and degrade the nearshore beach environment. Also, interim measures, such as beach scraping, would continue. The storm damage reduction project would basically move the ocean shoreline several hundred feet seaward and eliminate storm and erosion damages and the environmental consequences associated with these losses.

**9.08.10 Wescott Comment:** Page 23 has words to stress safety from hurricanes – The fact is Hwy. 158 is the “new road – and Hwy. 12 was the only road people know that. This project will not create additional roads.

**Corps Response:** Noted. If NC 12 is washed out, NCDOT would be responsible for taking the appropriate action to restore and maintain this transportation system.

**9.08.11 Wescott Comment:** Page 66, Page 141 should be reviewed carefully

**Corps Response:** Noted.

**9.08.12 Wescott Comment:** p. 14 "many of the seaward most buildings have been damaged . . . due to the loss of the dune system" – (1) There is a set back law; enforce it; insurance companies do not have to sell policies and the CCC men changed and created many of those dunes. The real "outerbankers" knew where to build.

**Corps Response:** Noted. Prevention of damages to upland development is in the interest of the nation. Shore protection projects that prevent these damages provide National Economic Development (NED) benefits to the nation.

**9.08.13 Wescott Comment:** Sections 6.04 and 6.07 and 6.10 need to be restudied carefully.

**Corps Response:** Noted.

**9.08.14 Wescott Comment:** Pages 37—41; 43 should be re-read and reconsidered as to this project.

**Corps Response:** Noted.

**9.08.15 Wescott Comment:** Residents have the choice of common sense to build other places; sandbags may be used in a limited fashion for a short period; developers (if they know geography) know the Carolina Coast and its shallow inlets, shallow-still sounds and quiet bays; therefore, this formidable, financial "bottomless-pit" project will do more harm than good. It truly is futile. And in the futility of it will probably erase marine life, vegetable (plant life) and human coastal life as we know it. The Corps of Engineers has made errors before in its dams and canals, please do not make bad worse!

**Corps Response:** We disagree. The proposed action is not futile and will not significantly impact the environment. Please review our responses to letters from USEPA, NMFS, and the USFWS, above.

**9.09 Dr. and Mrs. Sedan, letter dated August 14, 2000**

**Sedan Comment:** The Sedan's support the proposed action.

**Corps Response:** Noted.

**9.10 Mrs. Norman F. Perry, letter dated August 26, 2000**

**Perry Comment:** Mrs. Perry supports the proposed action.

**Corps Response:** Noted.